CLOUD ADOPTION

Great Expectations

Measuring cloud adoption is a complex task that can appear more black art than science. Definition and demographics are the crucial factors in understanding market size.

CLOUDSCAPE

KEY FINDINGS

- Data from several 451 Research teams shows that cloud adoption is growing fast, and cloud computing is benefitting from outsize market perception. But spending on cloud, however it's sliced and diced, remains a small portion of overall enterprise IT spending, and indeed small in terms of absolute dollars.

- Among large enterprises, only a tiny amount of budget is currently earmarked for public cloud projects, but planning a route to using public clouds is well under way. In the overall workload estate, the cloud occupies a small but strategically crucial place.

- While private clouds look like a major opportunity for infrastructure providers, they remain highly aspirational. Few adopters have moved beyond the basics and implemented key enabling technologies for private clouds.

ABOUT 451 RESEARCH

451 Research, a division of The 451 Group, is a leading global analyst and data company focused on the business of enterprise IT innovation. Clients of the company — at end-user, service-provider, vendor and investor organizations — rely on 451 Research's insight through a range of syndicated research and advisory services to support both strategic and tactical decision-making.

451 Research

New York

20 West 37th Street, 6th Floor
New York, NY 10018
Phone: 212.505.3030
Fax: 212.505.2630

San Francisco

140 Geary Street, 9th Floor
San Francisco, CA 94108
Phone: 415.989.1555
Fax: 415.989.1558

London

37-41 Gower Street
London, UK WC1E 6HH
Phone: +44 (0)20.7299.7765
Fax: +44 (0)20.7299.7799

Boston

125 Broad Street, 4th Floor
Boston, MA 02109
Phone: 617.275.8818
Fax: 617.261.0688

TABLE OF CONTENTS

SECTION 3: THE SHIFT TO THE CLOUD IS UNDER WAY 34

SECTION 4: THE CLOUD PROVIDER ECOSYSTEM 39

SECTION 5: CONCLUSIONS 42

INDEX OF COMPANIES 44

SECTION 1
Executive Summary

1.1 KEY FINDINGS

Measuring cloud adoption, and addressing cloud market sizing and forecasting, looks more like a black art than a science: Consider recorded revenue, projected market growth, spending intent and changes in behavior. Look at surveys from different firms, or indeed, different surveys from the same firms. The numbers can and do often appear wildly contradictory.

Definition and demographics are the crucial factors in understanding cloud market sizing. For example, market sizing that includes SaaS revenue will be very different from that which doesn't, while enterprise IT implementers have a different view than SMB technology consumers. This report uses 451 Research's own quantitative research tools to address and understand cloud market sizing and forecasting.

- CloudScape's early-adopter research program works with innovators, pathfinders and pioneers – enterprise end users that have been at the cutting edge of adoption (and this research pre-dates 'cloud'). It provides an aspirational point of view of cloud champions inside enterprise IT.

- Market Monitor uses 451 Research's deep knowledge of, and relationships with, established technology vendors and startups. It uses an analyst-centric methodology to count or estimate revenue from sales of cloud products and services.

- ChangeWave Research surveys a large group of business and technology professionals across different vertical markets. These are not all enterprise IT departments or people who represent enterprise IT spending (although some are). It's mostly smaller organizations and technology consumers for whom IT is not their day job. It uses a broad definition of cloud computing.

- TheInfoPro conducts hour-long interviews with IT professionals at large and midsize enterprises within its 700-strong TIP Commentator Network. These are people whose day jobs *are* IT. It has a very granular definition of cloud computing.

Although findings from each of the above services may appear at first glance to be somewhat contradictory, on closer examination we can conclude from each that: cloud adoption is growing fast; the cloud is being used widely (>50% for SaaS, for example); and cloud computing is certainly punching above its weight in terms of market perception.

But this is coming off a small revenue base. Remember, Amazon EC2 just had its sixth birthday. Spending on cloud, however it's sliced and diced, remains a small part of overall enterprise IT spending. Nevertheless, a shift toward the cloud 'as a service' is under way – it's a $15bn market in 2012 (73% of which is SaaS spending).

Among large enterprises, only a tiny amount of budget is currently earmarked for public cloud projects. But in a directional sense, planning a route to using public cloud is well under way. In the overall workload estate, the cloud occupies a small but strategically crucial place. Among enterprises, TheInfoPro finds that internal private clouds are the key cloud destination for workloads, not external clouds. This is less so among the smaller organizations surveyed by ChangeWave.

But a closer look at the detail under the headlines reveals that while private clouds look like a major opportunity for infrastructure providers, they remain highly aspirational. Few adopters have moved beyond the basics and implemented key enabling technologies for private clouds.

1.2 METHODOLOGY

This report uses 451 Research's own quantitative research tools to address and understand cloud market sizing and forecasting – CloudScape, Market Monitor, ChangeWave and TheInfoPro. It uses data from the most recent cloud surveys and forecasts from each service to illustrate how definition and demographics are key to understanding what the numbers and findings mean.

Reports such as this one represent a holistic perspective on key emerging markets in the enterprise IT space. These markets evolve quickly, though, so 451 Research offers additional services that provide critical marketplace updates. These updated reports and perspectives are presented on a daily basis via the company's core intelligence service – the 451 Market Insight Service. Forward-looking M&A analysis and perspectives on strategic acquisitions and the liquidity environment for technology companies are also updated regularly via the Market Insight Service, which is backed by the industry-leading 451 M&A KnowledgeBase.

Emerging technologies and markets are also covered in additional 451 practices, including our CloudScape, Enterprise Security, Eco-Efficient IT, Information Management, Infrastructure Computing for the Enterprise (ICE), Datacenter Technologies (DCT) and 451 Market Monitor services. All of these 451 services, which are accessible via the Web, provide critical and timely analysis specifically focused on the business of enterprise IT innovation.

This report was written by William Fellows, VP Research. Any questions about the methodology should be addressed to William Fellows at:
william.fellows@451research.com

For more information about 451 Research, please go to the company's website:
www.451research.com

SECTION 2
Cloud Adoption – What the Dickens?

Great Expectations

The industry is overflowing with market-sizing surveys and spending forecasts for cloud computing adoption. In our experience, they tend to be at the 'kitchen sink' end of the spectrum, where anything and everything that could conceivably be described 'as a service' is counted together with 'cloudwashed' product portfolios, irrespective of whether the key attributes of cloud computing are present or not.

This often includes what may have formerly been branded as managed services or hosting (even colocation), together with management fees, consulting and more. Some of these surveys also include – or are concerned specifically with – consumer spending on cloud offerings such as Apple iCloud or Dropbox. Some focus only on enterprise spending on public and/or private clouds.

The Old Curiosity Shop

Whatever is included in these market-sizing efforts, the numbers themselves often appear wildly contradictory. Consider vendor revenue from sales of cloud computing products and services on the one hand, and spending intent and anticipated future adoption among enterprise IT departments on another. Looking at 'change' in consumer spending behavior provides another view, while cloud spending in the context of general corporate IT purchasing and telecom industry trends offers other lenses entirely. Compare all these figures with actual adoption, and it's clear that further explanation is required.

A Tale of Two Cities

There are initially surprising contradictions in cloud market sizing, forecasting and survey work wherever one looks. Using 451 Research's own quantitative research tools – CloudScape, Market Monitor, ChangeWave and TheInfoPro (TIP) – as a foundation, we'll seek to explain how definition and demographics play a major role in creating the 'tale of two (or more) clouds,' as well as looking at the current fundamentals and dynamics of cloud revealed therein.

In essence, we'll see that cloud numbers that include SaaS revenue are much higher than those that don't; that IaaS and CaaS numbers vary widely depending on whether you allow virtualized stacks to be counted as cloud or whether the bar is set higher; and that this last issue causes the huge delta in IaaS spending intentions. Companies of all sizes certainly plan to spend more on virtualization; fewer of them intend to spend on the additional management layers to create a more strictly defined cloud. And, perhaps most interestingly, among large enterprises, only a tiny amount of budget is earmarked for public cloud projects at all!

2.1 CLOUDSCAPE

CloudScape's early-adopter research program has been running for more than 10 years. Over that time, we have worked with some 200+ early adopters, innovators, pathfinders and pioneers – enterprise end users that have been at the leading edge of spending and implementing emerging technologies. We have kept tabs on drivers and inhibitors, arcs of adoption and more.

Via grid computing and HPC, virtualization and utility computing, the program has morphed into a cloud computing program, since most participants now see the cloud as the logical endpoint for a combination of these things they've been doing and more. Often these adopters have been the same companies, and sometimes the same groups or even individual champions. Before cloud came along, the financial services folks were overrepresented in the program – but with the advent of cloud, everyone is showing up. Indeed, financial services users are not (at last at a corporate level) at the vanguard in cloud adoption.

Putting the Findings in Context

Some of the findings from our program are laid out here. The 2011 survey data doesn't provide any indication of actual dollar-value spending, but it does offer a fairly aggressive depiction of IaaS and PaaS use (less so for SaaS) within this demographic. Moreover, the workload snapshot provided in Figure 2 shows intent – an appetite to move from IT production applications to running business production workloads in the cloud (which we call 'playground to production').

It's not surprising that users in the CloudScape early-adopter research program have a high cloud adoption rate and appetite for increased use. These are by definition organizations that have been consistently willing to spend on emerging technology and innovation. Moreover, the survey asks about any use/adoption of cloud in these enterprises, which may be a very small fraction of the overall IT manifest. It's a highly aspirational view provided by (mostly) advocates and champions of cloud that are seeking to socialize their beliefs internally and to a wider audience of peers.

FIGURE 1: CLOUD ADOPTION SNAPSHOT: DELIVERY MODELS
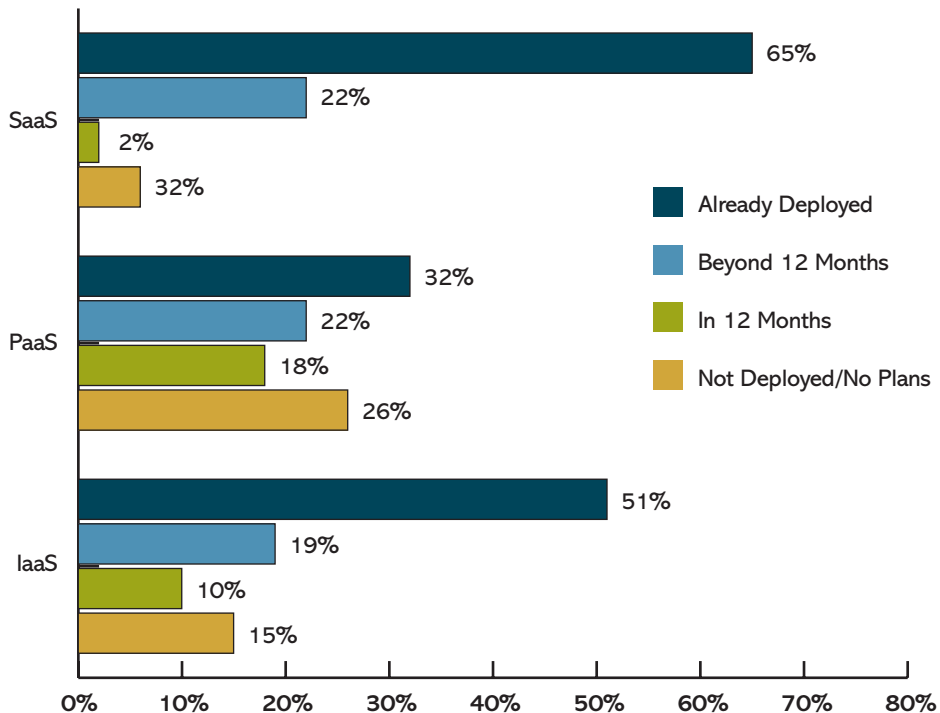
The interesting thing about Figure 2 is how it tracks a path from the 'playground to production' – initially running IT operations workloads and then moving to identify business production workloads as candidates for the cloud. The actual numbers (n=47 in this survey) are less interesting than the directional trend here. To be clear, the chart shows that some 60% of respondents were using cloud for T&D at the time of survey, and that an additional ~15% will be using it for T&D in 24 months' time. There's a surprising number of users with some mission-critical workloads running in the cloud, but by definition these are early-adopter end users.

FIGURE 2: CLOUD ADOPTION SNAPSHOT: WORKLOADS

% of Respondents

Legend: In 24 months, Present
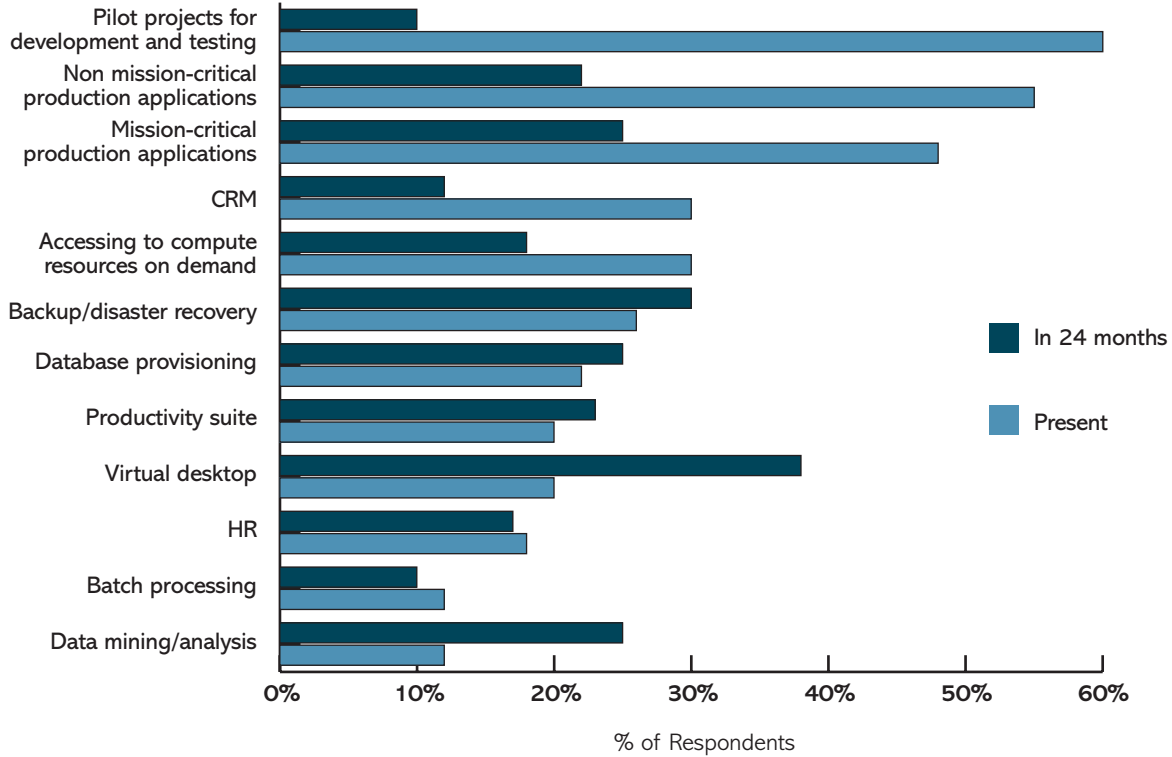
2.2 MARKET MONITOR

Market Monitor: Cloud Computing is a quantitative research service that tracks and forecasts over a five-year horizon the size and growth of the marketplace for cloud computing (and related) products. It uses a bottom-up approach to project industry revenues. The service breaks out revenue by geographic region, company size and industry verticals. There are two tracks within this research. The first is Cloud Computing: As-a-Service, which covers products specifically delivered as a service. The second is Cloud Computing: Cloud-Enabling Technologies, which tracks and forecasts the size and growth of the server virtualization and on-premises cloud-enabling technologies marketplace.

Putting the Numbers in Context

Market Monitor leverages 451 Research's deep knowledge of, and relationships with, established technology vendors and startups. It uses an analyst-centric methodology, relying heavily on active participation from sector analysts in setting estimates, especially for companies that don't publish revenue figures in full or in part. Estimating revenue for private companies using myriad tools is something we have been doing for the 13 years we have been in business. In addition, we have been careful to disaggregate revenue from cloud products, services and individual components from other products that aren't cloud-specific.

The result, we believe, is a pragmatic view of real revenue being achieved and forecast for the cloud as-a-service and cloud-enabling technologies sectors. When we talk about cloud as-a-service, we are generally leaving out enterprise applications in order to focus on the IaaS, PaaS and supporting infrastructure opportunities. It's worth emphasizing here how far cloud computing is 'punching above its weight' in becoming an effective proxy for transformation when we consider that 2012's $2bn+ IaaS market is less than some large organizations spend on their IT annually.

As far as cloud as-a-service is concerned, Market Monitor forecasts around $15.9bn for 2012, or $4.8bn when enterprise SaaS application revenue is stripped out (see Figures 3 & 4). The cloud as-a-service market as a whole is and will continue to be dominated by SaaS application sales (assuming SaaS continues to be counted here, which is not a given). The $4.8bn in revenue is from 260+ vendors operating in 16 segments of the marketplace – IaaS, PaaS and SaaS Infrastructure (IT Management as a Service, Online Backup and Cloud Archiving) – Figure 5. The 'classic' cloud piece – IaaS compute and storage offerings (see MM5) comprises 50% of this.

FIGURE 3: OVERALL CLOUD MARKET REVENUE ($BN)
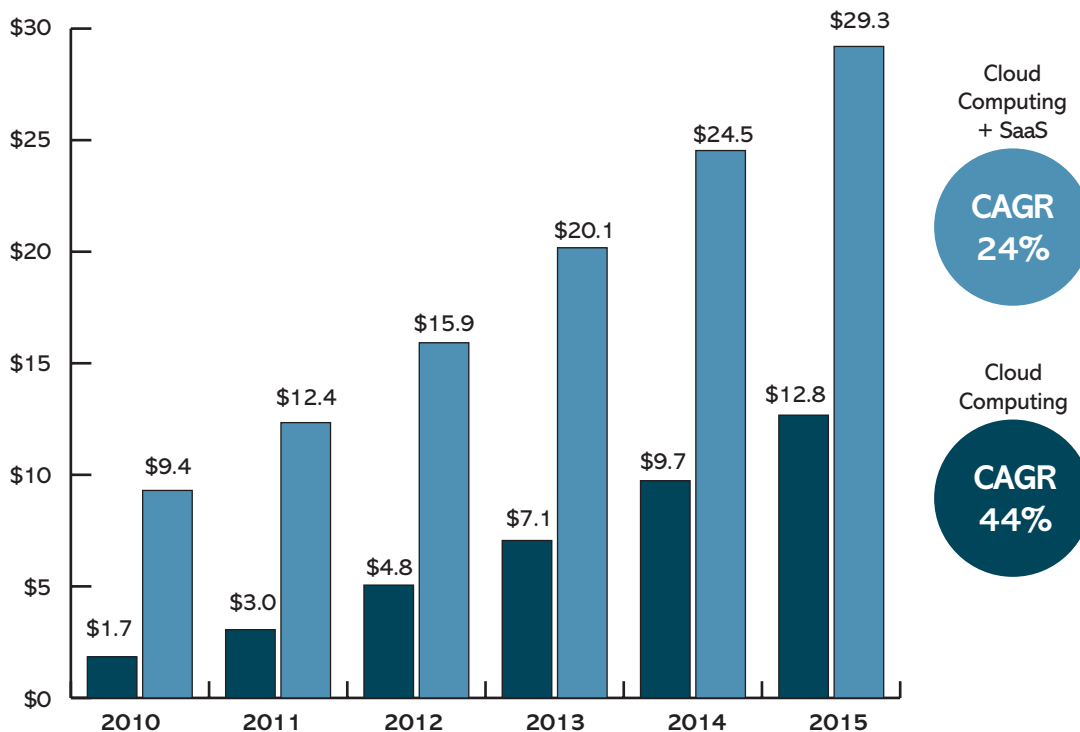
FIGURE 4: 2012 CLOUD REVENUE BREAKDOWN
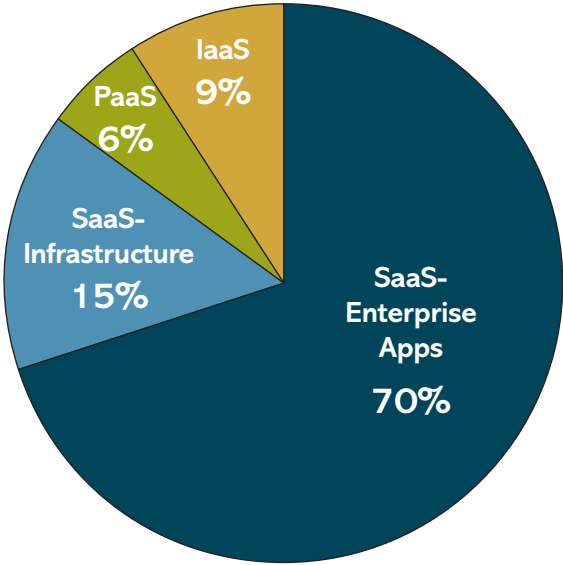
FIGURE 5: 2012 CLOUD REVENUE BREAKDOWN BY SUBSECTOR
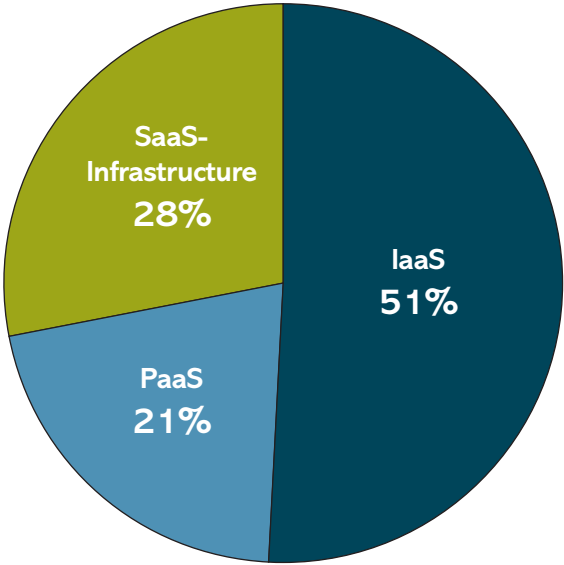
SEGMENT	VENDOR COUNT
TOTAL CLOUD	**262**
IAAS	**129**
Compute & Storage-as-a-Service	123
Stand-Alone Cloud Storage	9
PAAS	**73**
PaaS from SaaS	12
Stand-Alone PaaS	33
Application Lifecycle Management as a Service	31
Pre-Production/Testing	*18*
Integration-as-a-Service	*13*
SAAS-INFRASTRUCTURE	**87**
Online Backup	20
Cloud Archiving	10
IT Management-as-a-Service	64
IT Service Management	*10*
System and Network Monitoring & Management	*44*
Resource Utilization, Capacity Planning and Billing	*16*

Considering Figure 5, a number of things spring to mind. First this is not (yet) a massive market. Just to put the size of the cloud market into perspective, some financial services companies spend as much on IT annually as the whole IaaS market generates. Second is that this market remains Amazon's to lose. While Amazon is about half of the IaaS market, it's not so true as it was even a year ago to say that if Amazon is Coke them

there isn't really a Pepsi. Instead, what we are seeing is a range of 'colas' coming to market with real revenue and – perhaps even more importantly – determination, backed by investment, to win in this market.

Rackspace's annual revenue run rate for cloud services is more than $100m. Vendors as diverse as Verizon, HP, CSC, NTT Group and SoftLayer are chasing down the opportunity – although not making up ground on Amazon. Microsoft (Azure) and Google (Cloud Platform) are now chasing the IaaS opportunity after lackluster success in PaaS. Our estimates for IaaS are on the conservative side of the fence, and while Amazon's AWS revenue isn't known, we suspect that it's at least 10x any other vendor's – except for Rackspace. (It's worth reiterating this is cloud as-a-service, not private cloud enablement.)

The cloud-enablement market, meanwhile, will be worth some $10.64bn this year. This includes 154 vendors operating across seven segments of the marketplace – including server virtualization and management, backup, HA, security and I/O virtualization.

PaaS (No Thoroughfare)

FIGURE 6: PAAS MARKET OVERVIEW ($M)

'PaaS from SaaS' proving successful

Legend:
- salesforce.com
- Google
- Microsoft
- Intuit
- Engine Yard
- Others

2011-2015 CAGR **46%**

2010	2011	2012	2013	2014	2015
$359	$664	$1,034	$1,582	$2,244	$3,042
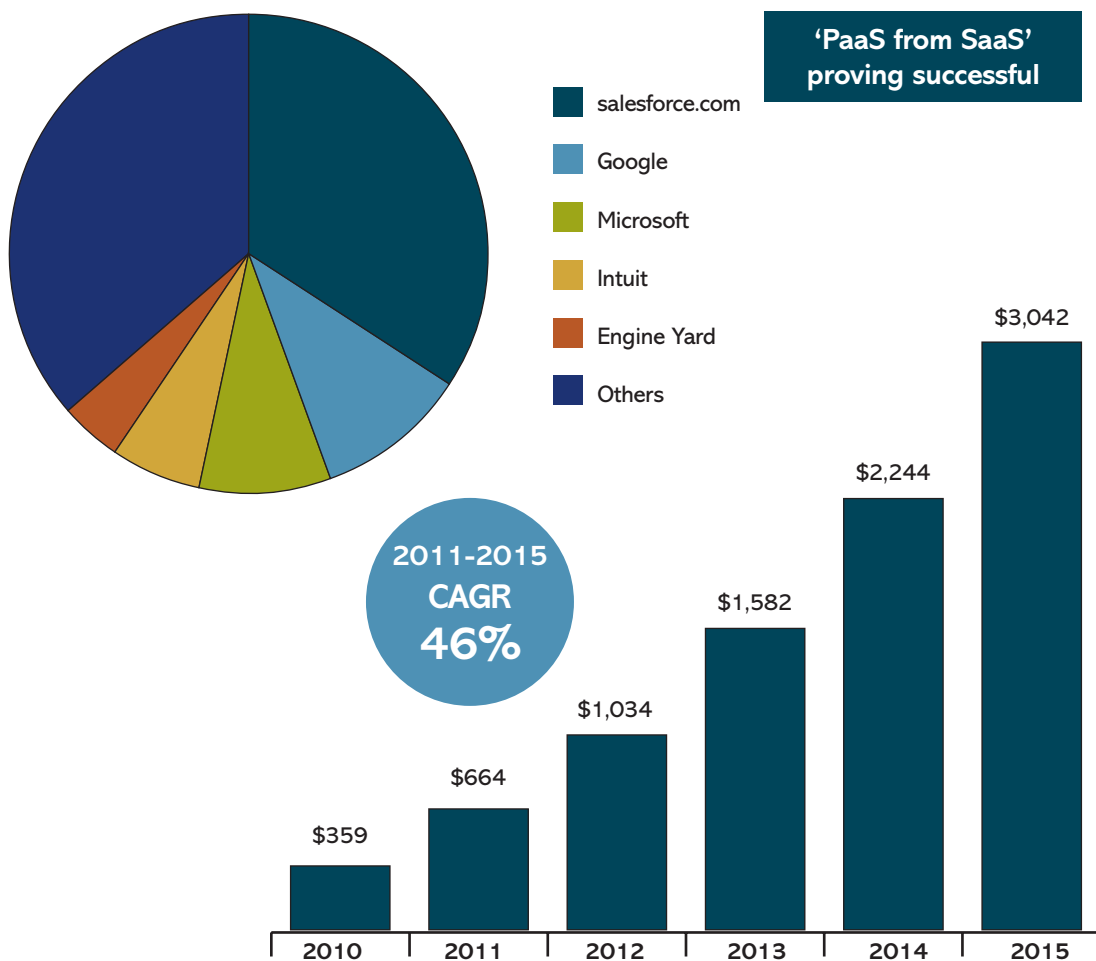
The PaaS market has yet to meet – with the exception of salesforce.com – the expectations that had been held for it by the early entrants, Microsoft and Google. Neither could make a real business of PaaS, and both have gone off and done IaaS. Although it's still a bit early to call, we think the case for PaaS is finally starting to add up.

To begin with, the 'PaaS from SaaS' model is proving to be the most commercially successful approach for PaaS offerings – those platforms on which multiple applications can share resources and user information, subject to tight controls (see Figure 6). This is where platform capabilities were once basically an extension framework for SaaS apps (such as Salesforce CRM), but today are independent-yet-linked entities.

Whether as above or in native PaaS environments, we've seen the creation of very valuable marketplaces (Heroku), and now every vendor worth its salt is trying to create an application market to 'ring fence' ISV platform integration, royalty revenue and improved customer value. Certainly an ISV with real value has to have a PaaS story – it underpins new approaches to packaging, integration and mobility.

PaaS supports the burgeoning polyglot programming paradigms and has institutionalized and industrialized continuous development and delivery vs. traditional models. For end users, PaaS no longer needs to mean lock-in. Private PaaS and 'roll your own' environments bring the opportunity to avoid business and technical risks that come with public cloud computing.

It has taken time, but the use of private PaaS as a 'black box' environment, enabling IT departments to retain control of security and performance characteristics, is also coming into view. They can automate development processes and tie them to standardized application infrastructures, yet at the same time provide developers with an agile environment. This may end up being the underlying model for applications built for cloud. There are a raft of companies making this bet. Moreover, the lines are blurring in any case.

Consider pure PaaS plays shifting toward IaaS and vice versa – with Microsoft adding Linux and messaging support to Azure, VMware CloudFoundry offering a route into both camps, and Amazon's Elastic Beanstalk on EC2. On the downside, our view is that hosted PaaS largely remains the model that has characterized this space, and it remains automated vendor lock-in. We find PaaS to be way down the CIO 'to do' list, and just of a slew of 'aaS' projects now need to be considered.

FIGURE 7: CLOUD 'AS A SERVICE' REVENUE BY GEOGRAPHY
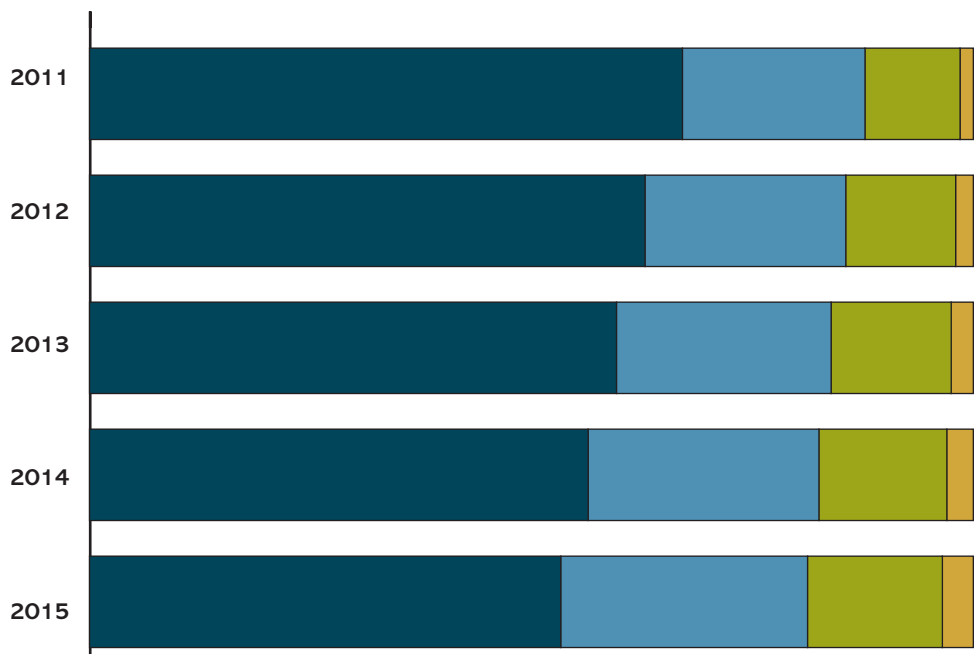
CLOUD COMPUTING	NA	EMEA	APAC	LATAM
2011	67%	21%	11%	2%
2012	63%	23%	12%	2%
2013	60%	24%	14%	3%
2014	56%	26%	14%	3%
2015	53%	28%	15%	4%

The geographic breakdown in Figure 7 reflects just how much North America still dominates the scene – although other markets are now coming on stream.

FIGURE 8: IAAS VENDORS: GEOGRAPHIC DISTRIBUTION BY HQ
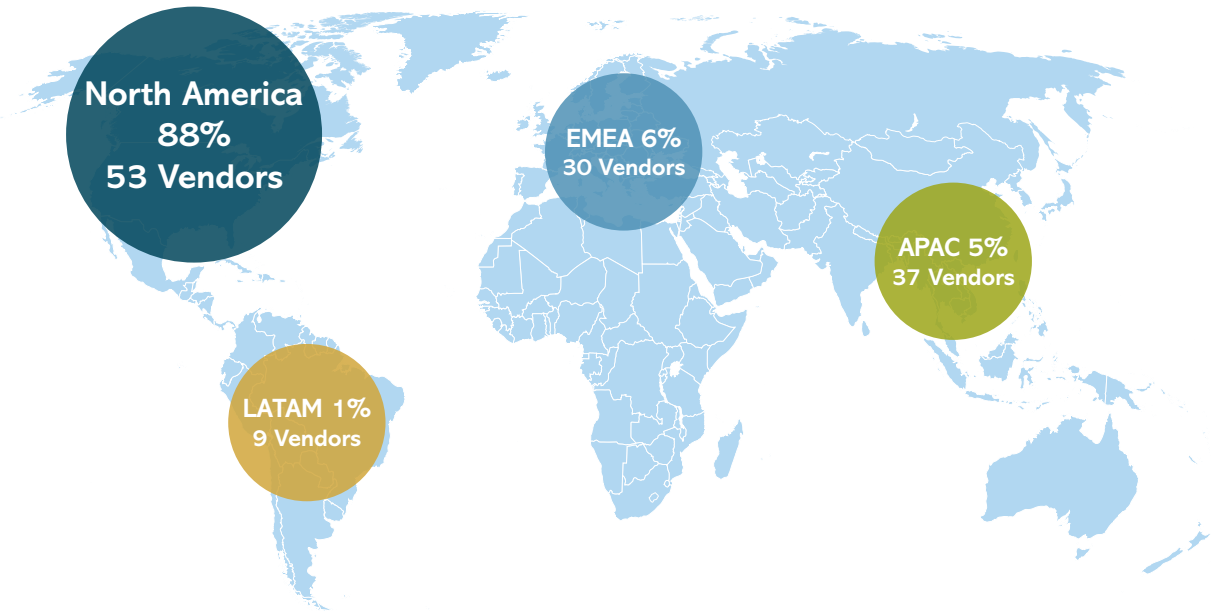
When we factor in where the revenue is reported (Figure 8) vs. where it's being collected (or at least where the customer spend is – Figure 9), we see the market being even more skewed toward North America.

For an examination of regional CloudScape trends, please see our recent long-form reports on cloud adoption in Europe and China.

FIGURE 9: IAAS VENDORS: GEOGRAPHIC REVENUE DISTRIBUTION

North America 63%

EMEA 23%

APAC 12%

LATAM 2%
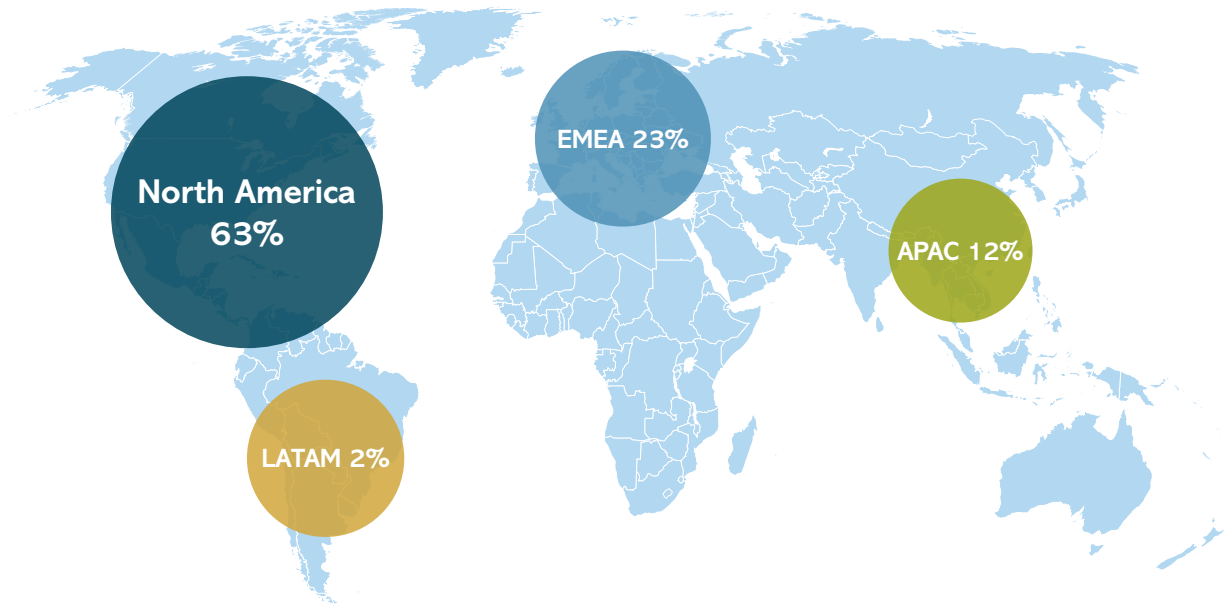
Phase Transition

The summary position for cloud market sizing is that in its early days, the cloud has been – and largely continues to be – primarily a device for running project-based workloads, test & development, batch processes and IT production tasks. It has been used to circumvent internal provisioning constraints rather than to augment an organization's IT resources, and has been focused mainly on infrastructure.

However, this is changing as companies seek to capture the benefits of the cloud more broadly, on both a private and public basis. Figure 10 charts this phase transition in terms of spending forecast, with a focus on a wider set of workloads, and the automation and management technologies needed to support them.

FIGURE 10: CLOUD MARKET EVOLUTION

Phase 2: Management of Cloud Enviroments

Products
Initial Cloud Engagements
Focused on Infrastructure

Cloud-as-a-Service
Revenue: 44% CAGR
2011-2015

$12.8bn

Customers
Developers
SMBs

Phase Transition
Investments, Product Intros &
New Deals Point to:
Increase in Private Activity
Higher-End Data
Shift Up the Stack

Focus
Greater Traction with
Management Products &
Vertical Offerings

Workloads
Test & Development
Project-Based
'Public Clouds Dominate'

Customers
Enterprise Adoption
Elevates Market

$1.7bn

Workloads
Production &
Mission-Critical
'Focus Shifting to
Private/Hybrid Clouds'

Phase 1: On-Demand Infrastructure

2010   2011   2012   2013   2014   2015

2.3 CHANGEWAVE

ChangeWave's research is based on a weekly series of proprietary large-sample surveys of the ChangeWave Network, a group of more than 25,000 business and technology professionals – along with early-adopter consumers. These individuals represent a broad cross-section of vertical markets – including software, hardware, telecom, energy, healthcare, manufacturing and multiple retail sectors.

Putting the Numbers in Context

Unlike TheInfoPro (see Section 2.4), these ChangeWave Network members are not enterprise IT departments or staff who make enterprise IT spending decisions (although some are). It's mainly smaller organizations and technology consumers for whom IT is not their day job. The definition of cloud computing used in the ChangeWave survey instrument is also broader than that of TheInfoPro.

ChangeWave's definition states that: *Public cloud computing (i.e., 'renting' or provisioning the remotely hosted computing resources of a service provider) can be broken down into three main categories: Software as a Service (e.g., salesforce.com), Platform as a Service (e.g., Google AppEngine), and Infrastructure as a Service (e.g., Amazon EC2).*

Moreover, while the ChangeWave findings reflect current cloud use, future adoption and changes in spending – across SaaS, PaaS and IaaS – they don't reveal actual dollar-value spending or the proportion of applications/workloads going into the cloud. However while we're talking about *relative* change here, the surveys nevertheless provide evidence that that there is cloud adoption and use, which is real, and it's increasing.

A total of 1,165 respondents involved in their company's buying decisions participated in the July 10-26 survey, including 369 whose companies currently use public cloud services. This latest survey of business cloud computing trends shows an apparently explosive leap in actual usage and a surge in corporate migration to the cloud:

- 32% of corporate respondents reported their company currently uses public cloud computing services – a 3-point uptick since the previous quarter (Figure 11).

- 37% of current cloud users plan to *increase* their cloud spending in the next six months (Figure 12).

- 34% (+2) say their company will be using public cloud computing six months from now (Figure 13).

- 23% report their company currently uses private cloud. Of this, 69% are housed at in-company datacenters and 26% at a third-party provider (5% don't know).

The ways cloud is currently used are:

- *Software as a Service – 66%*

- *Infrastructure as a Service – 32%*

- *Platform as a Service – 32%*

FIGURE 11: CURRENT PUBLIC CLOUD USAGE: CORPORATE MARKET

Percentage of Respondents Whose Companies Currently use
Applications that Run on Public Cloud Computing Services
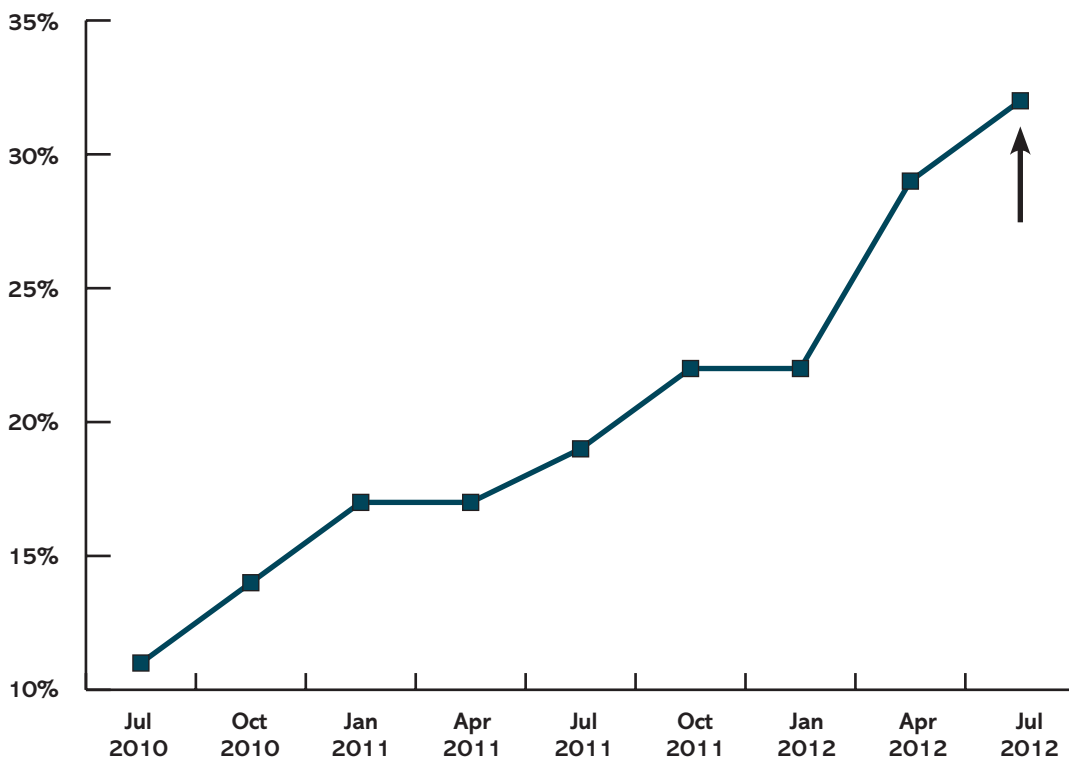
Spending Trends – Current Public Cloud Users. We also took a closer look at business spending patterns only among companies that are currently using the cloud.

FIGURE 12: PUBLIC CLOUD SPENDING PLANS

Over the <u>next 6 months</u>, does your company plan to increase its overall spending on public cloud computing or decrease its spending, or will your company's overall cloud spending remain the same compared to the previous 6 months?

COMPANIES CURRENTLY USING PUBLIC CLOUD	CURRENT SURVEY JULY '12
Increase Overall Spending	37%
Decrease Overall Spending	1%
No Plans to Use Cloud Computing in Next 6 months	8%
Remain the Same	54%

FIGURE 13: PUBLIC CLOUD USAGE PLANS

Current Cloud Usage vs. Future Cloud Usage July 2012
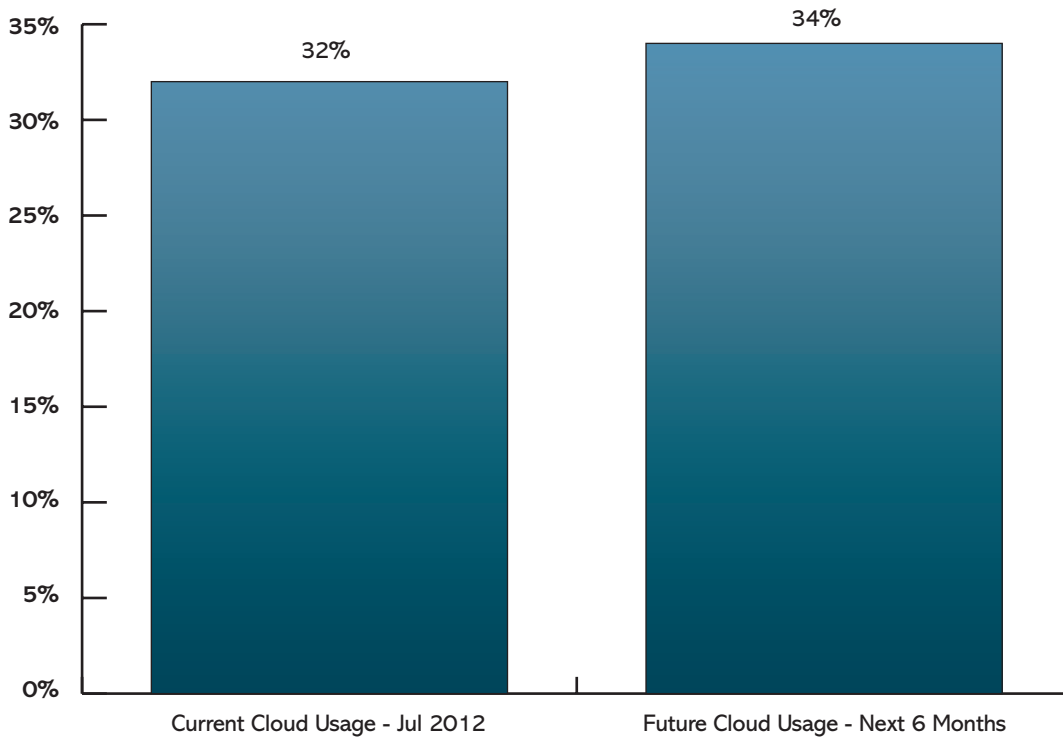
FIGURE 14: PUBLIC CLOUD USAGE MODELS

With regard to public computing, in which of the following ways does
your company use cloud computing services? July 2012
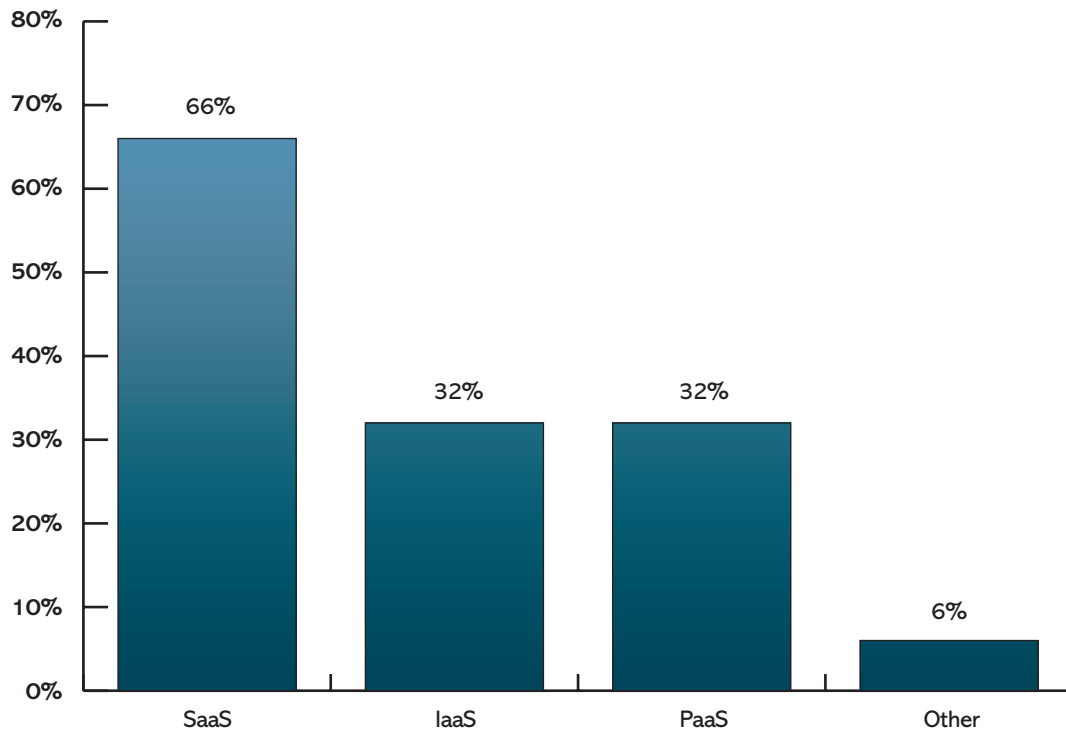
When ChangeWave asked survey respondents which vendors their company plans to increase cloud-related spending on over the next six months, it found the following:

FIGURE 15: PLANNED CLOUD SPENDING BY PROVIDER TYPE

Plan on increasing company spending on cloud-related products/services over next 6 months

Platform Providers

Provider	Percentage
Microsoft	20%
Google	20%
Salesforce.com/Force.com	20%
VMware/Cloud Foundry	12%

Telecom Providers

Provider	Percentage
AT&T	13%
Verizon/Terremark	13%

Hosting

Provider	Percentage
Amazon	20%
Rackspace	13%
GoDaddy	6%

0%   5%   10%   15%   20%
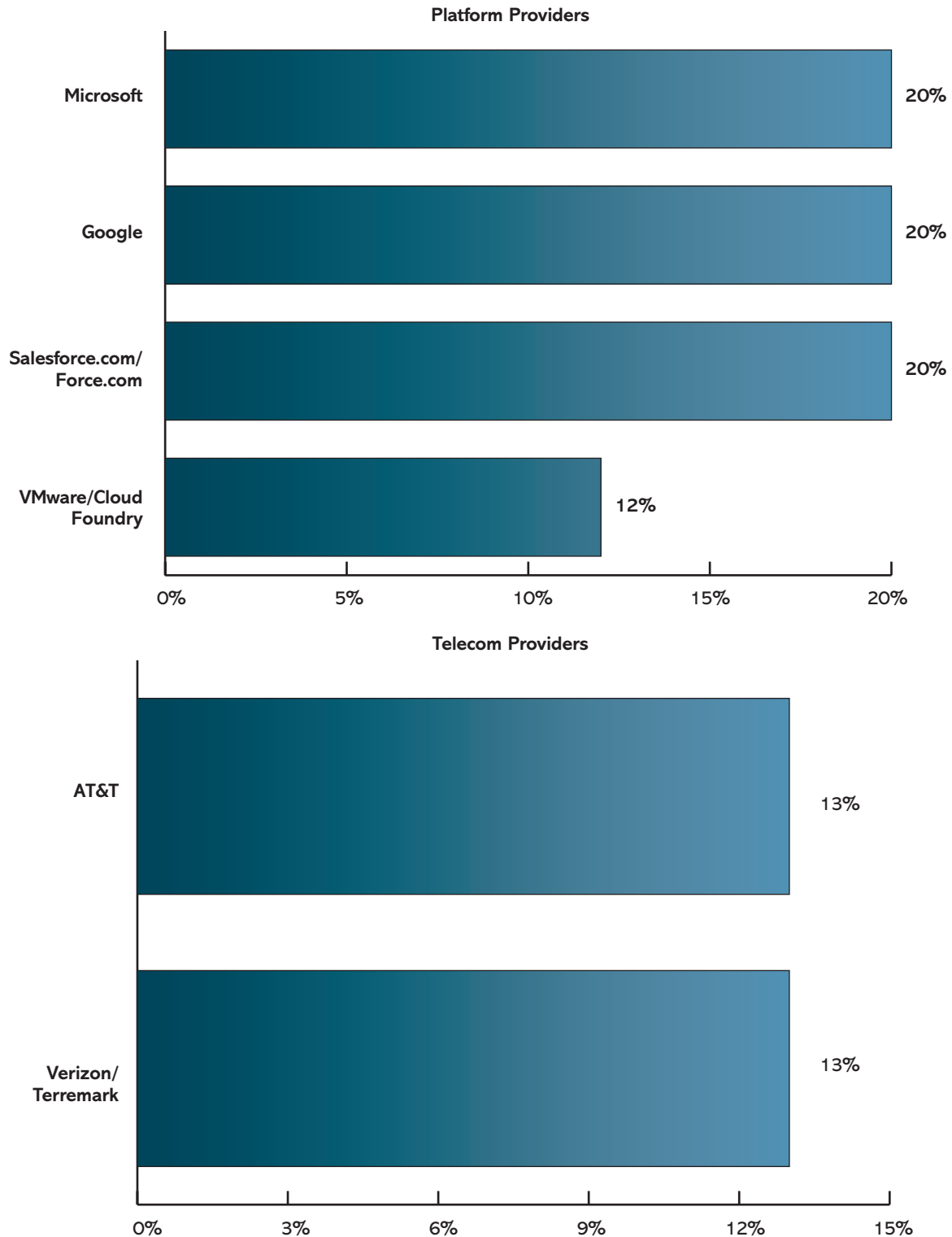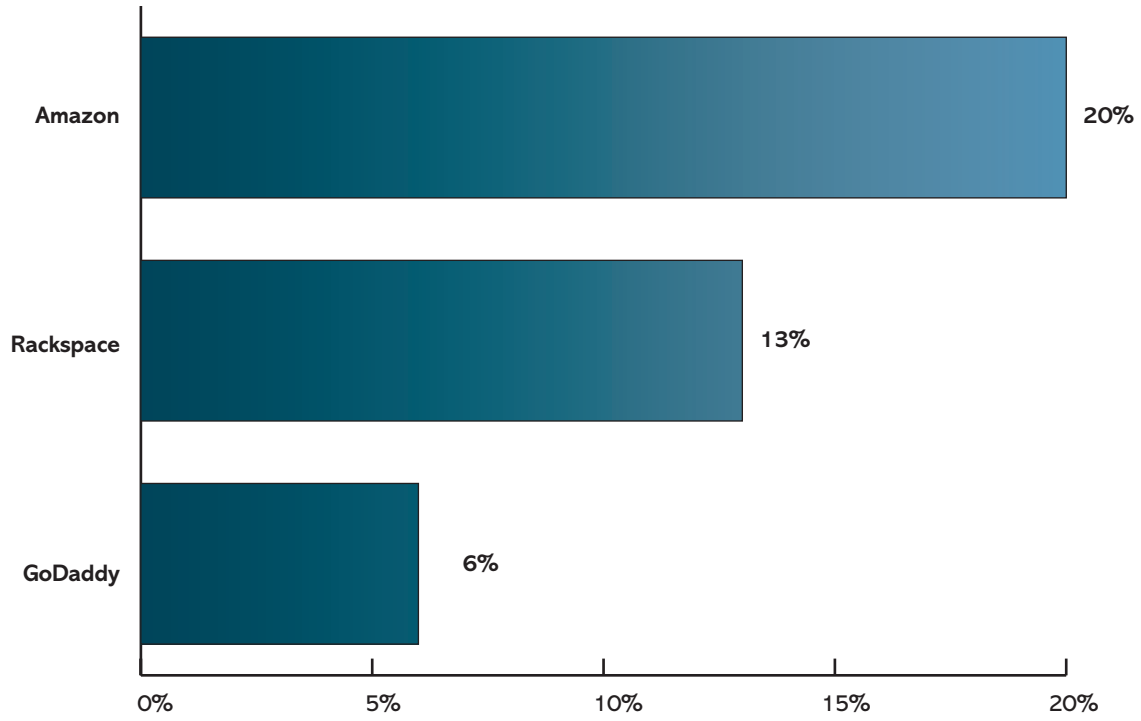
Other IT Service Providers

Provider	Percentage
IBM	8%
HP	5%
CSC	3%
Dell	3%

0% 1% 2% 3% 4% 5% 6% 7% 8%
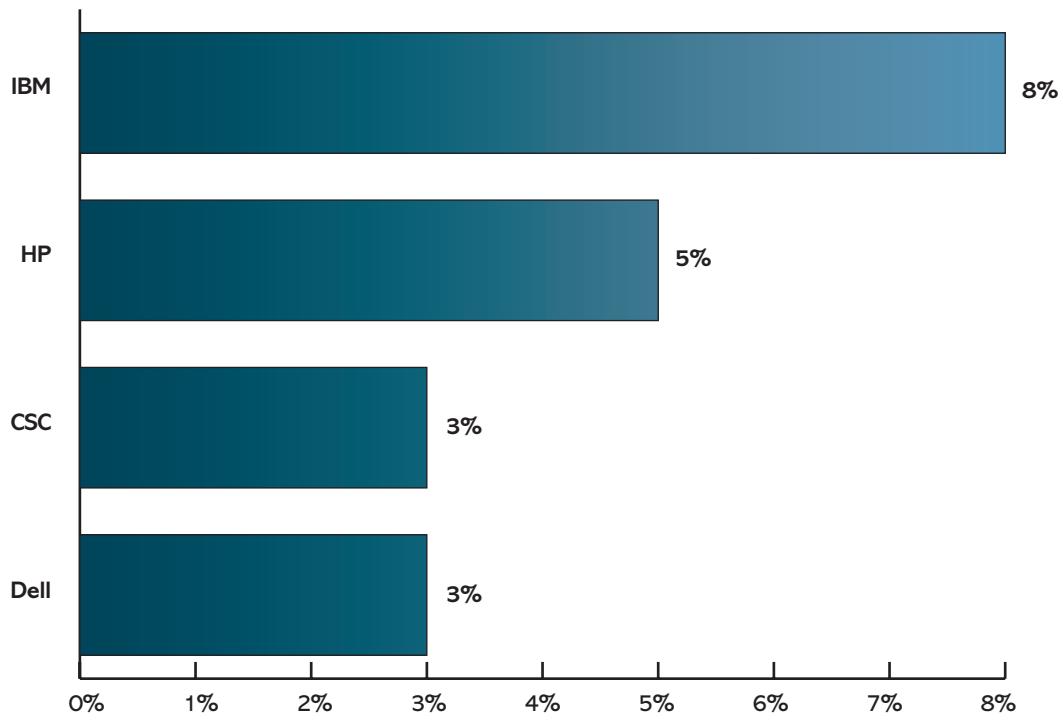
2.4 THEINFOPRO

TheInfoPro is 451 Research's 'voice of the customer.' TIP conducted hour-long interviews with IT professionals at 68 large and midsize enterprises within its 700-strong TIP Commentator Network for the Wave 3 Cloud Computing Study survey results we have used here. These are people *whose day jobs are IT*.

The Wave 3 Study provides a crucial reality check for 451 Research's analysis of the cloud marketplace. First and most importantly, it reveals that actual spending on public cloud services – in terms of both overall IT budget and percentage of workloads running on cloud – is small. This is mirrored by our view from Market Monitor that the total spending on cloud (minus SaaS) is smaller than some companies' entire annual IT budget – this is actual dollar value. Second, the TIP research reveals cloud adoption patterns that are wholly consistent with ChangeWave, CloudScape and Market Monitor – specifically, that SaaS is most penetrated, and IaaS penetration is at or above 25% for survey respondents.

The Wave 3 Cloud Computing Study reveals that cloud penetration is at 52% for SaaS and 24% IaaS (compute and storage) across the survey base (see Figure 16).

FIGURE 16: TECHNOLOGY ROADMAP: CLOUD-SPECIFIC HARDWARE, SOFTWARE & SERVICES

What is your status of implementation for this technology?

	IN USE NOW	IN PILOT/ EVALUATION (BUDGET HAS ALREADY BEEN ALLOCATED)	NEAR-TERM PLAN (IN NEXT 6 MONTHS)	LONG-TERM PLAN (6-18 MONTHS)	PAST LONG-TERM PLAN (LATER THAN 18 MONTHS OUT)	NOT IN PLAN	DON'T KNOW
Software as a Service (Public Cloud - SaaS)	52%	2%	2%	7%		37%	2%
On-ramp Services	13%		7%	3%	2%	68%	7%
Compute as a Service (Public Cloud - IaaS)	12%	2%	2%	6%	4%	71%	4%
Storage as a Service (Public Cloud - IaaS)	12%	2%	2%	6%	4%	72%	3%
Commercial or Open Source Cloud Orchestration Stack	9%	6%	10%	15%	2%	56%	3%
Private Cloud Appliances	7%	7%	7%	10%	3%	63%	2%
Cloud Metering and Billing Software	6%	3%	4%	4%	2%	78%	3%
Hybrid Cloud Integration	4%	4%	2%	9%	4%	74%	3%

The Wave 3 Cloud Computing Study also found that spending on cloud-specific technologies is going to accelerate.

FIGURE 17: CLOUD TECHNOLOGIES: SPENDING CHANGE

How will your spending on this technology change in 2011 as compared to 2010?
How will your spending on this technology change in 2012 as compared to 2011?
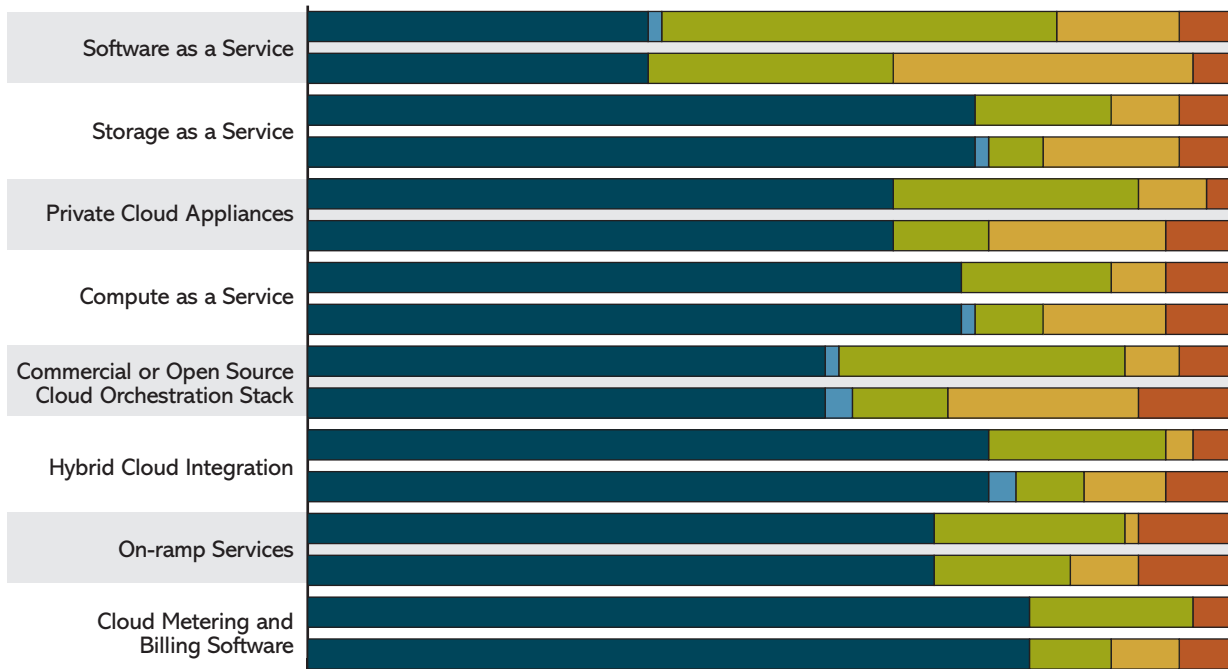
	NOT USING THE TECHNOLOGY	LESS SPENDING	ABOUT THE SAME	MORE SPENDING	DON'T KNOW
Software as a Service	37%	1%	43%	13%	6%
	37%		26%	32%	4%
Storage as a Service	72%		15%	7%	6%
	72%	1%	6%	15%	6%
Private Cloud Appliances	63%		26%	7%	3%
	63%		10%	19%	7%
Compute as a Service	71%		16%	6%	7%
	71%	1%	7%	13%	7%
Commercial or Open Source Cloud Orchestration Stack	56%	1%	31%	6%	6%
	56%	3%	10%	21%	10%
Hybrid Cloud Integration	74%		19%	3%	4%
	74%	3%	7%	9%	7%
On-ramp Services	68%		21%	1%	10%
	68%		15%	7%	10%
Cloud Metering and Billing Software	78%		18%		4%
	78%		9%	7%	6%

However, in terms of 2011 budget allocations, only 3% of actual spending went to public cloud offerings (both SaaS and IaaS).

FIGURE 18: IT BUDGET ALLOCATION BY DELIVERY MODEL

Please estimate what percentage of the overall 2011 IT budget went to the following external service delivery models. Please include spending on servers, storage, network, infrastructure, desktops and devices, IT staff, infrastructure, middleware and applications, but exclude professional services or telecom.
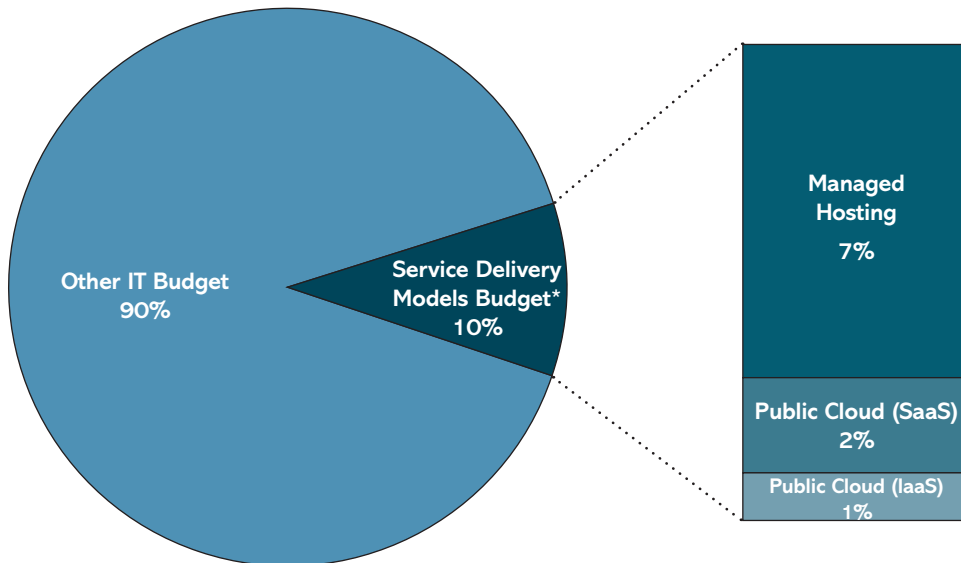
The study also found that internal clouds are the key destination for most workloads, not external public clouds.

FIGURE 19: SERVICE DELIVERY PLATFORMS IN USE

For each of the following, what percentage is deployed on the different service delivery platforms?

Private Cloud 39%

Dedicated Physical 50%

ITO/Hosting 8%
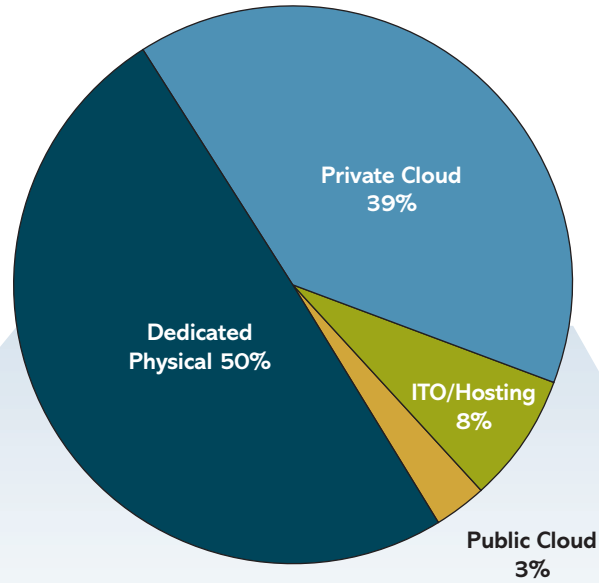
Public Cloud 3%

90% of Workloads Remain In-House

ERP

Financial Management Software

Structured Data Storage and Retrieval

Batch Workload Execution

Online Transaction Processing (OLTP)

Unstructured Data and Storage Retrieval

Productivity/Collaboration (Email, SharePoint)

IT Systems Management

Human Capital Management

Business Continuity and/ or Disaster Recovery

Custom-built Applications

CRM

Application Servers (Non-ERP, Non-email)

Development and Test
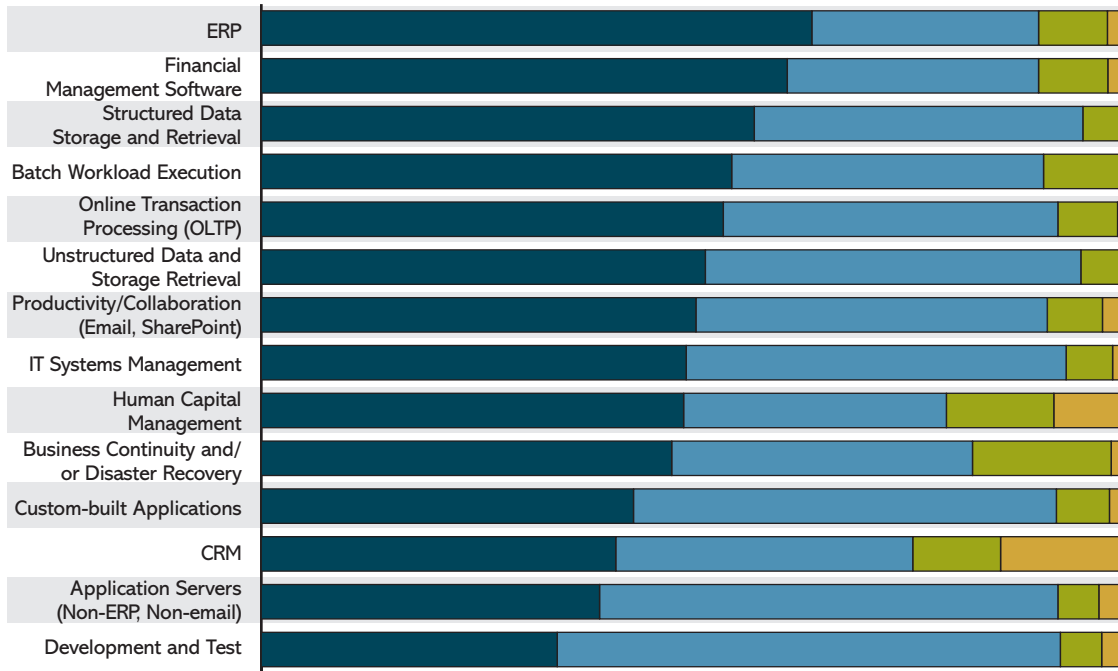
FIGURE 19: SERVICE DELIVERY PLATFORMS IN USE (CONTINUED)

	DEDICATED PHYSICAL	PRIVATE CLOUD	ITO/HOSTING	PUBLIC CLOUD
ERP	64%	26%	8%	2%
Financial Management Software	61%	29%	8%	2%
Structured Data Storage and Retrieval	57%	38%	5%	
Batch Workload Execution	55%	36%	9%	
Online Transaction Processing (OLTP)	54%	39%	7%	1%
Unstructured Data and Storage Retrieval	52%	44%	5%	
Productivity/ Collaboration (Email, SharePoint)	50%	41%	6%	2%
IT Systems Management	49%	44%	5%	1%
Human Capital Management	49%	30%	12%	8%
Business Continuity and/or Disaster Recovery	48%	35%	16%	1%
Custom-built Applications	43%	49%	6%	2%
CRM	41%	34%	10%	14%
Application Servers (Non-ERP, Non-email)	39%	53%	5%	3%
Development and Test	34%	58%	5%	3%

The study further finds that internal clouds, not public clouds, are the key focus of future cloud spending – at 42% of survey respondents (see Figure 20). Even more striking is that a majority of those interviewed indicated their top project under way is building out internal private clouds. At the same time, enterprises are also in the midst of planning out their public cloud projects, with 27% highlighting that they are assessing the benefits of the public cloud and 8% indicating that a public cloud implementation is a key project.

What are your organization's top two cloud-related projects in the next 12 months?*

Internal Cloud — 42%
Public Cloud Assessment — 27%
SaaS — 15%
Cloud Email — 10%
Public Cloud Implementation — 8%
Internal Management — 5%
Internal Storage — 5%
Cloud Storage — 3%
Hybrid Cloud — 3%
Internal Cloud Migration — 3%
Management — 3%

"We're building a foundation based on UCS and vSphere which we expect will position us to leverage commercial cloud offerings in the future." – IT pro at an MSE education organization

"[We will] grow starting with private cloud, then strongly consider external clouds. Planning on getting a cloud readiness assessment from IBM." – IT pro at an MSE financial services company

Workload Distribution Between Hosted Services

So, despite all the 'cloud hype,' TIP finds that only 3% of enterprise workloads are currently located in an external public cloud (Figure 19). A further 8% of applications and workloads are located in an IT outsourcing or hosted environment. Spending on external service delivery as a whole accounted for 10% of overall IT budgets. External service delivery includes spending on SaaS, IaaS and managed hosting. According to this data, we are still in the very early stages of using the public cloud – 50% of work-loads and applications reside on dedicated physical infrastructure, while 40% have been placed into an internal virtualized environment.

Private Clouds

Continuing this discussion, if building out internal private clouds is the key priority for end users, it will be the market sectors supplying the basic tools for this –virtualiza-tion and converged infrastructure vendors – that will be experiencing accelerated adop-tion and spending. Indeed, Figure 21 shows that users continue to virtualize their server environments. A full 60% of respondents said that they plan to increase spending in 2012 on hypervisors, up from 43% in 2011.

FIGURE 21: VIRTUALIZATION: SPENDING CHANGE

How will your spending on this technology change in 2011 as compared to 2010?
How will your spending on this technology change in 2012 as compared to 2011?

	NOT USING THE TECHNOLOGY	LESS SPENDING	ABOUT THE SAME	MORE SPENDING	DON'T KNOW
Server Virtualization - Hypervisor		7%	32%	60%	
		3%	53%	43%	1%
Virtualization Administration/Monitoring	9%	1%	53%	37%	
	9%		63%	26%	1%
Virtualization Management	12%	1%	47%	38%	1%
	12%		65%	21%	3%
I/O Virtualization	47%		24%	21%	9%
	47%		24%	21%	9%
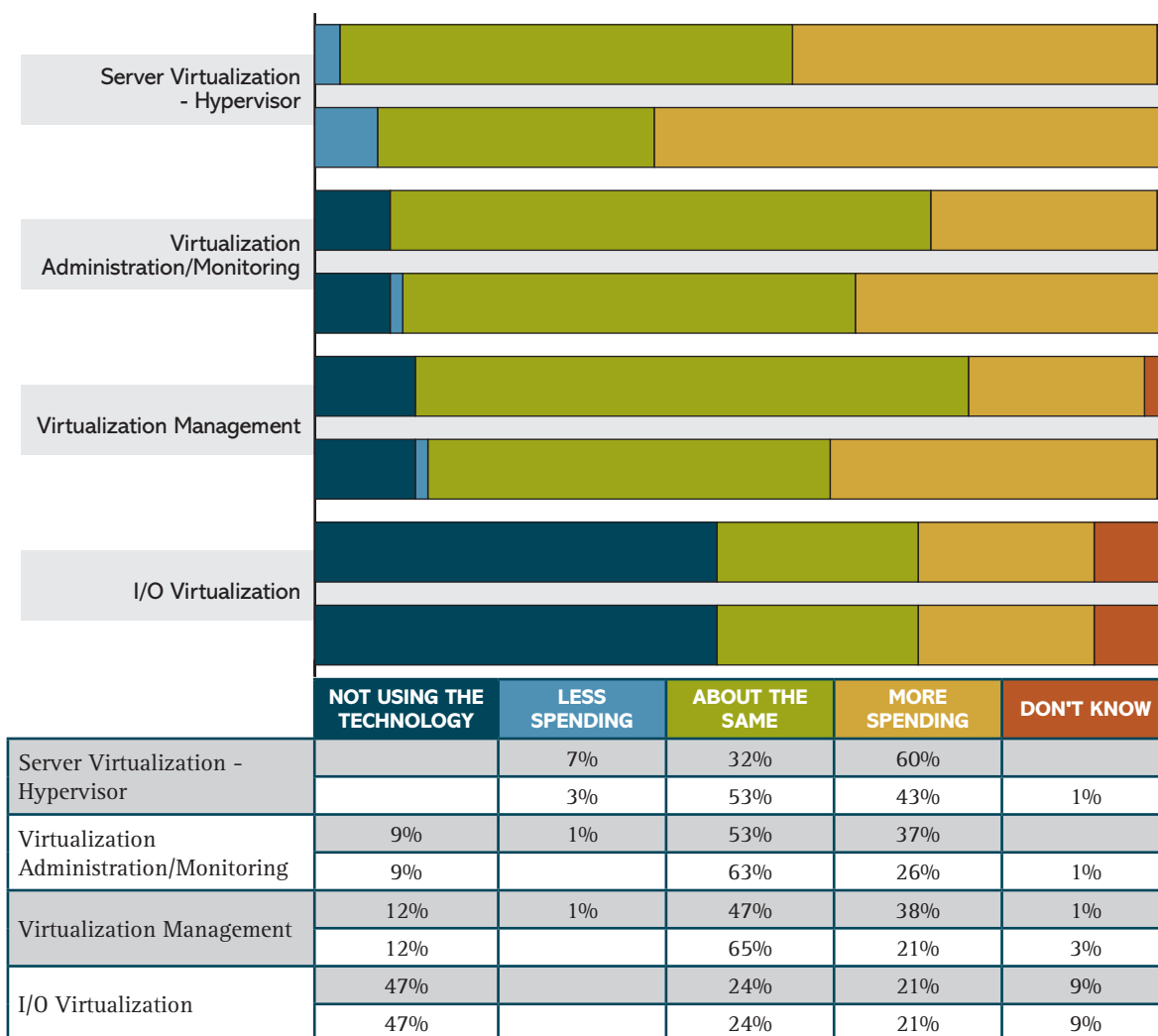
A deeper look, however, reveals that despite the appetite for private clouds, few have moved beyond the basics and implemented key private cloud-enabling technologies. Some of this is clearly aspirational. End users may be disposed to simply referring to their VMware stacks as a 'private cloud' (which is great for VMware), but if an internal private cloud is defined as an automation, orchestration and governance layer that sits on top of the virtualization layer, then according to the TIP data, enterprises are at the very early stages of implementation. In fact only a very few have actually implemented the requisite automation and orchestration that would enable them to come close to replicating the provisioning speed and economics of the leading service providers.

If enterprises are to really mimic the speed of provisioning achieved by public clouds, they will need to expand automation throughout the infrastructure stack, which includes server, storage and automation. Figure 22 shows that aside from server virtualization, enterprises are fairly mature in the implementation of automated server provi-

sioning (41% in-use and another 28% in-plan), which is often the tip of the automation spear within most organizations. However, both storage and network automated provisioning are only lightly implemented, with 16% and 13%, respectively, indicating that they currently have the technology implemented within their organization.

With regard to spending, our results show increasing plans for automated server provisioning, as the number indicating that they will raise spending on the technology increased from 5% in 2011 to 41% in 2012. However, spending on automated server and storage automation looks anemic, with only 16% and 7%, respectively, indicating they will spend more on the technology in 2012.

FIGURE 22: THE STATE OF PRIVATE CLOUD ADOPTION

Phase in Journey to Internal Private Cloud
In moving to an internal private cloud environment, what phase are you currently in?

- Assessment of Cost/ Benefit - 16%
- IT Audit - 6%
- Identification - 6%
- Operational Strategy - 21%
- Implementation - 47%
- No Plans - 4%
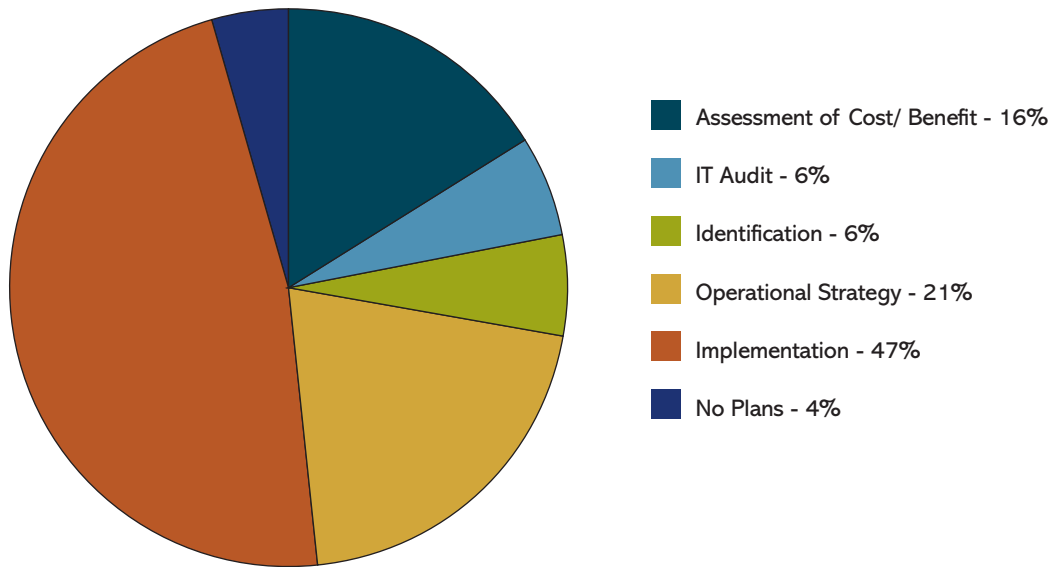
Continued on next page...

Roadmap for Private Cloud Technologies
What is your status of implementation for this technology?

	IN USE NOW	IN PLAN	NOT IN PLAN	DON'T KNOW
Automated Server Provisioning	41%	28%	31%	2%
Automated Storage Provisioning	16%	16%	66%	2%
Automated Network Provisioning	13%	6%	75%	6%
On-ramp Services	13%	12%	68%	7%
Cloud Orchestration Stack (Commercial or Open Source)	9%	32%	56%	3%
Integrated Cloud Platforms (Private Cloud Appliances)	7%	28%	63%	2%
On-ramp Services	13%	12%	68%	7%
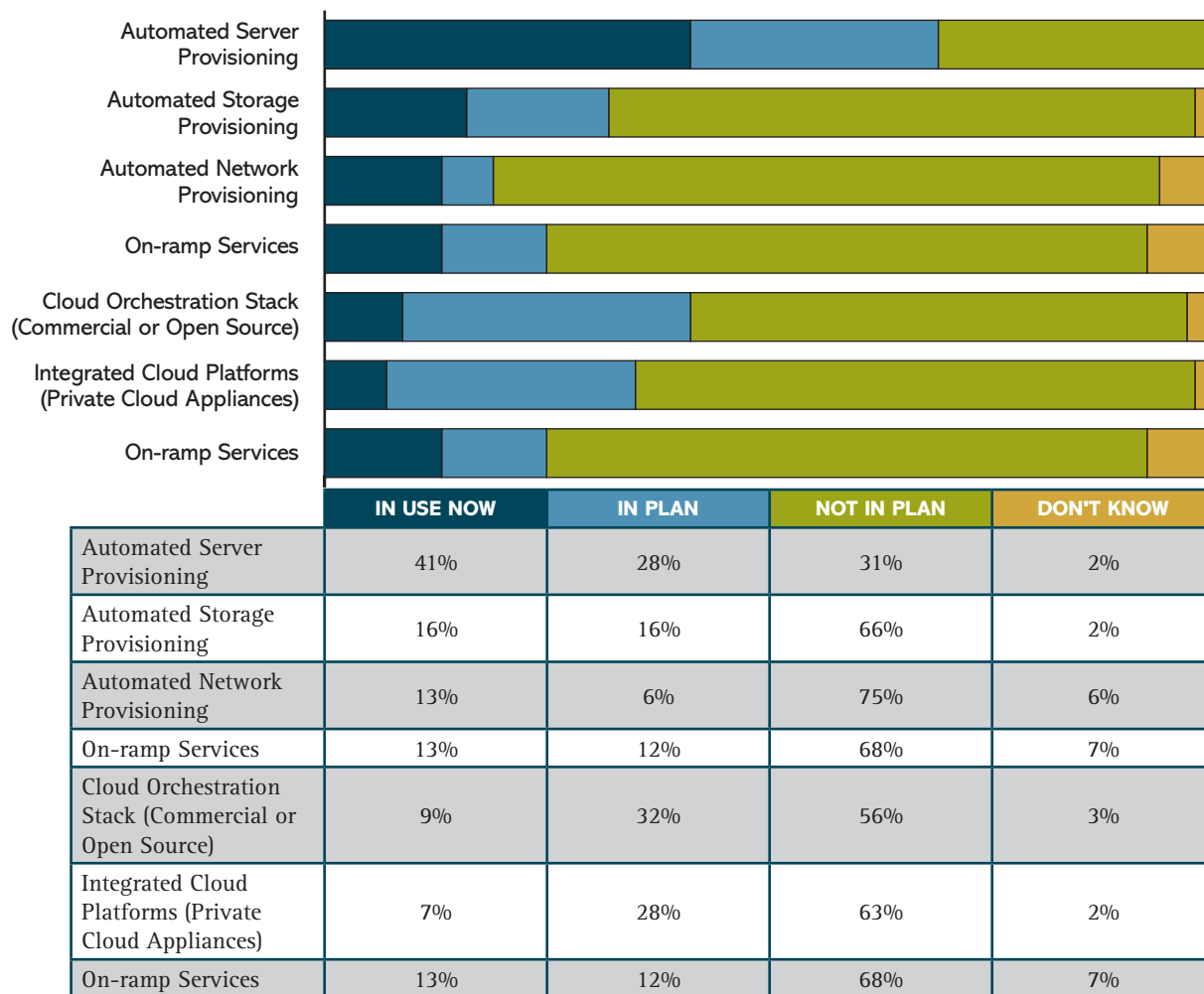
Building a Public-Cloud-Ready Infrastructure

We saw in Figure 20 that more than one-quarter of enterprises are planning a route to using public clouds. There will clearly be organizational changes and maturing of existing processes required in order to use public clouds (from a corporate policy point of view, rather than ad hoc developer/guerilla use). Some combination of technical functions are also likely to be required in order to take advantage of in-house resources coupled (loosely or closely) to hosted elastic resources in a hybrid deployment – including orchestration, governance, metering, lifecycle management, migration and on-ramping. These tools will assist enterprises in executing workloads on an optimal infrastructure.

That infrastructure can be a mix of internal or external, scalable IaaS or bare-metal dedicated infrastructure. It can be local, or it can be on the other side of the world. It will be the infrastructure itself that decides where to place workloads, and it will make decisions based on an assortment of policy factors and cost. Hybrid strategies

will require a single management interface or cloud control panel that enables users to manage which execution venues (private internal, private hosted, public cloud) that applications and workloads run in.

Examples here include launching a new website on a public cloud and then migrating it to internal resources, or running a staging environment internally and sending a production site to external resources or creating separate mobile delivery on a public cloud. This is less about cost than it is about flexibility. This is about enabling users to make rational choices about what to run where. Cloud on-ramp vendor RightScale says 90% of its prospects are now seeking such hybrid cloud strategies.

It's worth noting that cloud providers including Amazon and Rackspace, as well as entrants such as HP, are offering ways to connect users' own resources to public clouds – or to connect different classes of resources (say, managed or dedicated to public) within their own universe. This takes some of the risk out of public clouds for end users, which can retain a 'single throat to choke' for their multiple types of sourcing.

Orchestration

Orchestration tools bring resources together in response to the demands of specific applications/workloads and services, hiding the nuances of the underlying virtualization tier and exposing them to on-demand provisioning through Web services APIs. Nine percent (9%) of respondents said they have an orchestration stack in place today, (see Figure 23), while 33% said they plan to pilot or implement such technology within the next 18 months.

VMware, Citrix and Eucalyptus look well positioned here, with HP, BMC, VCE, IBM and EMC also in users' spending plans. Other vendors on the map with reference customers include enStratus, Gale Technologies and ServiceMesh.

FIGURE 23: CLOUD ORCHESTRATION STACK IMPLEMENTATION

	IN USE NOW	IN PILOT/ EVALUATION (BUDGET HAS ALREADY BEEN ALLOCATED)	NEAR-TERM PLAN (IN NEXT 6 MONTHS)	LONG-TERM PLAN (6-18 MONTHS)	PAST LONG-TERM PLAN (LATER THAN 18 MONTHS OUT)	NOT IN PLAN	DON'T KNOW
1H '12	9%	6%	10%	15%	2%	56%	3%

	NO SPENDING	LESS SPENDING	ABOUT THE SAME	MORE SPENDING	DON'T KNOW
2012 vs. 2011	56%	3%	10%	21%	10%
2011 vs. 2010	56%	2%	31%	6%	6%
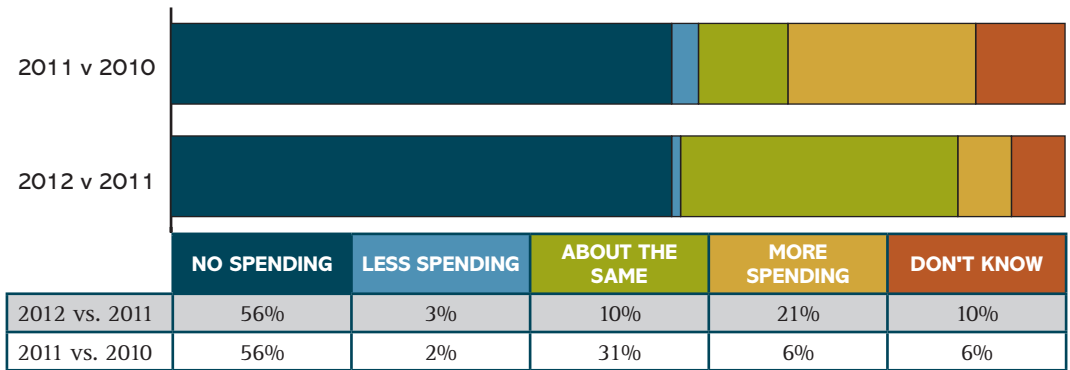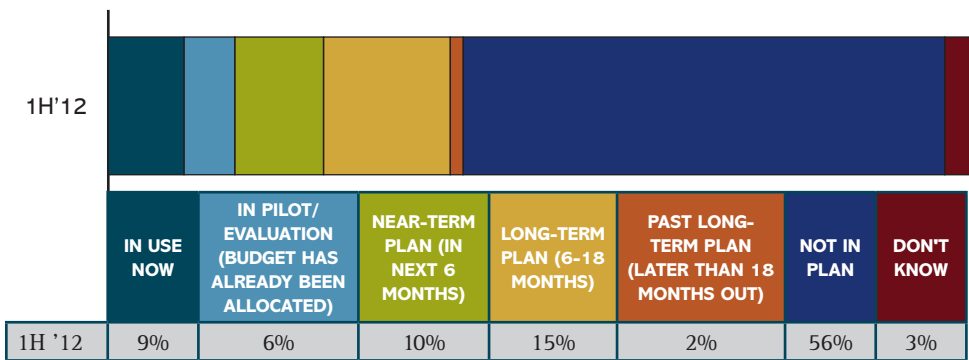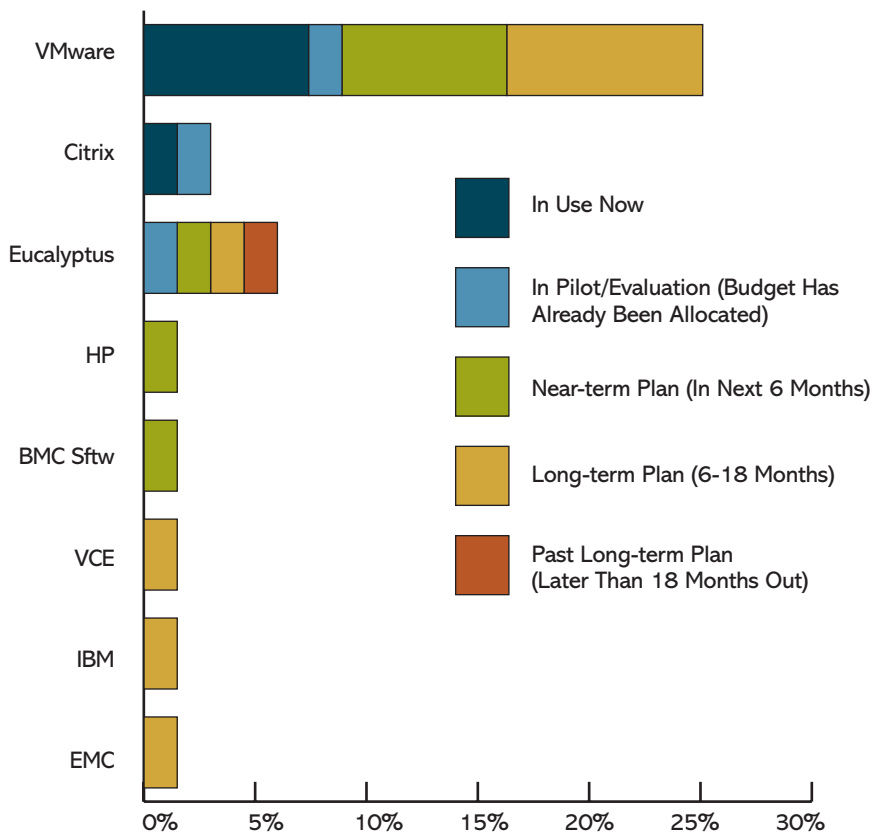
One red flag here is that aside from the immaturity of offerings in the space, it's still not clear where the orchestration function and responsibility will reside/roll up to. ISVs (including SAP, for example) are embedding rudimentary orchestration telemetry into their products, which can be activated by lightweight third-party tools. If this model becomes dominant, it may obviate the need for the kind of deep and broad lifecycle management and orchestration tools now on the market. It's too early to call at this stage, however, but it would mean cloud service providers and cloud management companies may be able to pick up the orchestration function instead of pure plays.

On-Ramps, On-Boarding, Migration

Other tools in the box will be on-ramping, on-boarding and migration technologies that help enterprise to execute workloads on an optimal infrastructure. As we've pointed out, this infrastructure can be a mix of internal or external, scalable IaaS or dedicated – and it can be located anywhere. The infrastructure decides where to place workloads based policy factors and cost.

Enterprises moving workloads into production public cloud environments will also need specialized versions of datacenter systems management infrastructure that enable IT staff to manage, monitor, provision and de-provision resources in a cloud environment – most users don't have such technology in their planning horizon. While current adoption of these technologies within the enterprise is small, use and expected adoption is increasing.

Enterprises will also need on-ramp capabilities, which reduce the potential variations and minimize the risks associated with moving services into production public cloud environments. However, only 13% of those interviewed indicated that they currently have an on-ramp tool in place today, with another 12% planning the implementation of such a tool.

FIGURE 24: TECHNOLOGY ROADMAP: CLOUD-SPECIFIC HARDWARE, SOFTWARE & SERVICES

What is your status of implementation for this technology?

	IN USE NOW	IN PILOT/ EVALUATION (BUDGET HAS ALREADY BEEN ALLOCATED)	NEAR-TERM PLAN (IN NEXT 6 MONTHS)	LONG-TERM PLAN (6-18 MONTHS)	PAST LONG-TERM PLAN (LATER THAN 18 MONTHS OUT)	NOT IN PLAN	DON'T KNOW
Software as a Service (Public Cloud - SaaS)	52%	2%	2%	7%		37%	2%
On-ramp Services	13%		7%	3%	2%	68%	7%
Compute as a Service (Public Cloud - IaaS)	12%	2%	2%	6%	4%	71%	4%
Storage as a Service (Public Cloud - IaaS)	12%	2%	2%	6%	4%	72%	3%
Commercial or Open Source Cloud Orchestration Stack	9%	6%	10%	15%	2%	56%	3%
Private Cloud Appliances	7%	7%	7%	10%	3%	63%	2%
Cloud Metering and Billing Software	6%	3%	4%	4%	2%	78%	3%
Hybrid Cloud Integration	4%	4%	2%	9%	4%	74%	3%

SECTION 3
## The Shift to the Cloud Is Under Way

3.1 REALITY CHECK

Data from TIP's Wave 3 Cloud Computing Study clearly shows that while adoption of cloud as-a-service is gaining steam, it remains a relatively small activity in terms of spending at present – 90% of applications and workloads still reside in-house. Of those, 50% of workloads and applications reside on dedicated physical infrastructure, while 40% have been placed into an internal virtualized environment (see Figure 19). Meanwhile, only 3% of applications and workloads are currently hosted in an external cloud – and this includes SaaS.

Nevertheless, a shift to the cloud as-a-service is under way – it's a $15bn market in 2012. Moreover, we point the reader to Market Monitor's overview of the cloud-enablement market here, which includes virtualization (server, storage, I/O), automation and management, and security. The 2012 spend here is forecast to be $10.28bn, rising to $17.46bn in 2015.

Indeed, for those on a journey to cloud adoption, we find that there's an equal amount of planning going on at the same time as implementation.

FIGURE 25: PHASES IN THE JOURNEY TO THE CLOUD

In moving to an internal private cloud environment, what phase are you currently in?
In moving to a external public cloud environment, what phase are you currently in?
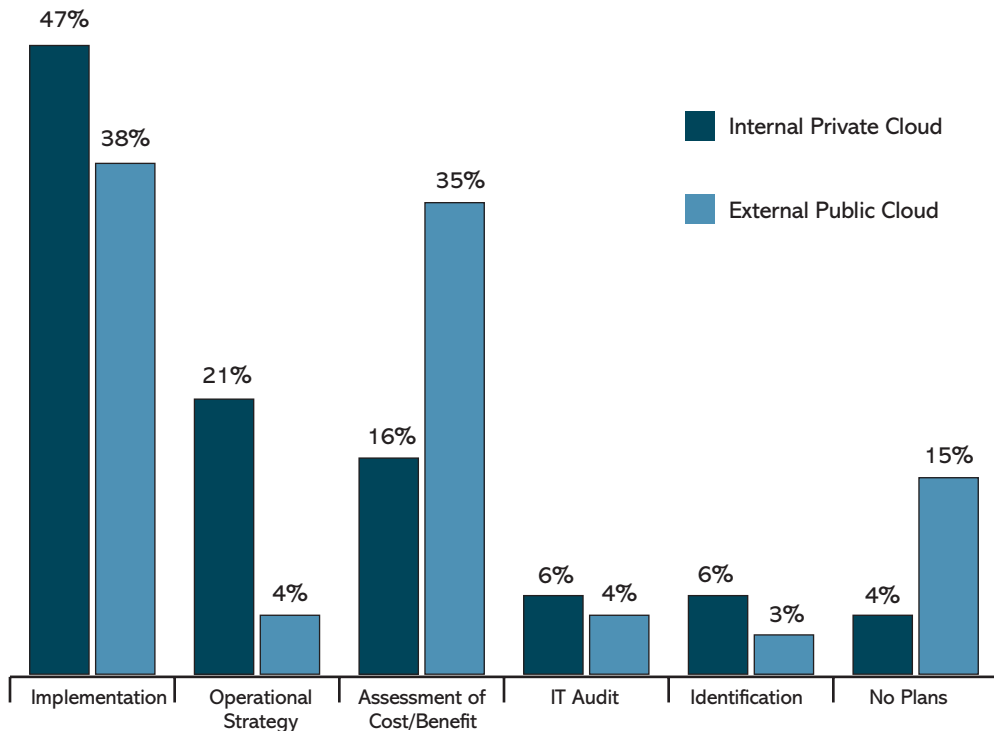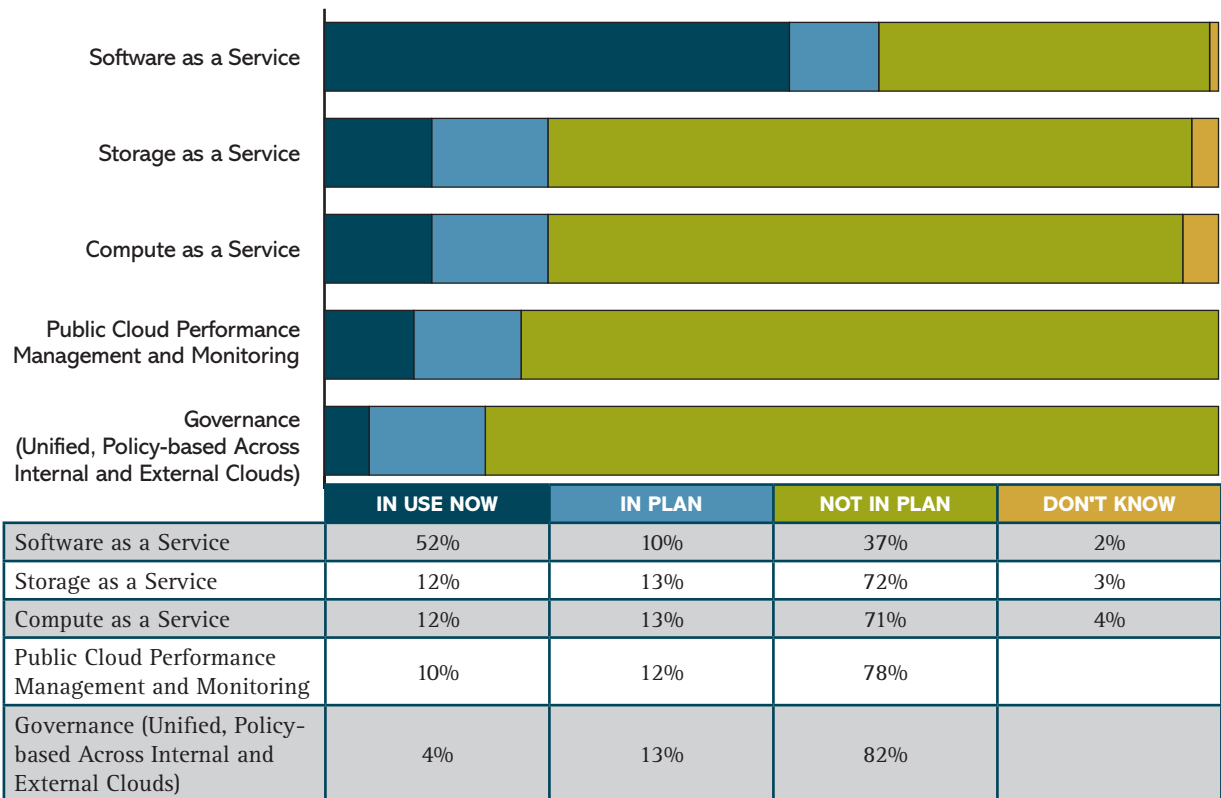
3.2 IS ANYBODY OUT THERE?

What Figure 26 reveals is that planning for public cloud use is well under way. SaaS is the most mature and most widely adopted public cloud model within the enterprise today – 52% of respondents said they currently have a SaaS offering in place today, while another 11% have it within their plans. As far as public IaaS is concerned, 12% of respondents have it in use (compute and storage), while 14% have it in plan.

FIGURE 26: PUBLIC CLOUD ADOPTION

What is your status of implementation for this technology?

	IN USE NOW	IN PLAN	NOT IN PLAN	DON'T KNOW
Software as a Service	52%	10%	37%	2%
Storage as a Service	12%	13%	72%	3%
Compute as a Service	12%	13%	71%	4%
Public Cloud Performance Management and Monitoring	10%	12%	78%	
Governance (Unified, Policy-based Across Internal and External Clouds)	4%	13%	82%	

Governance
4% In-Use
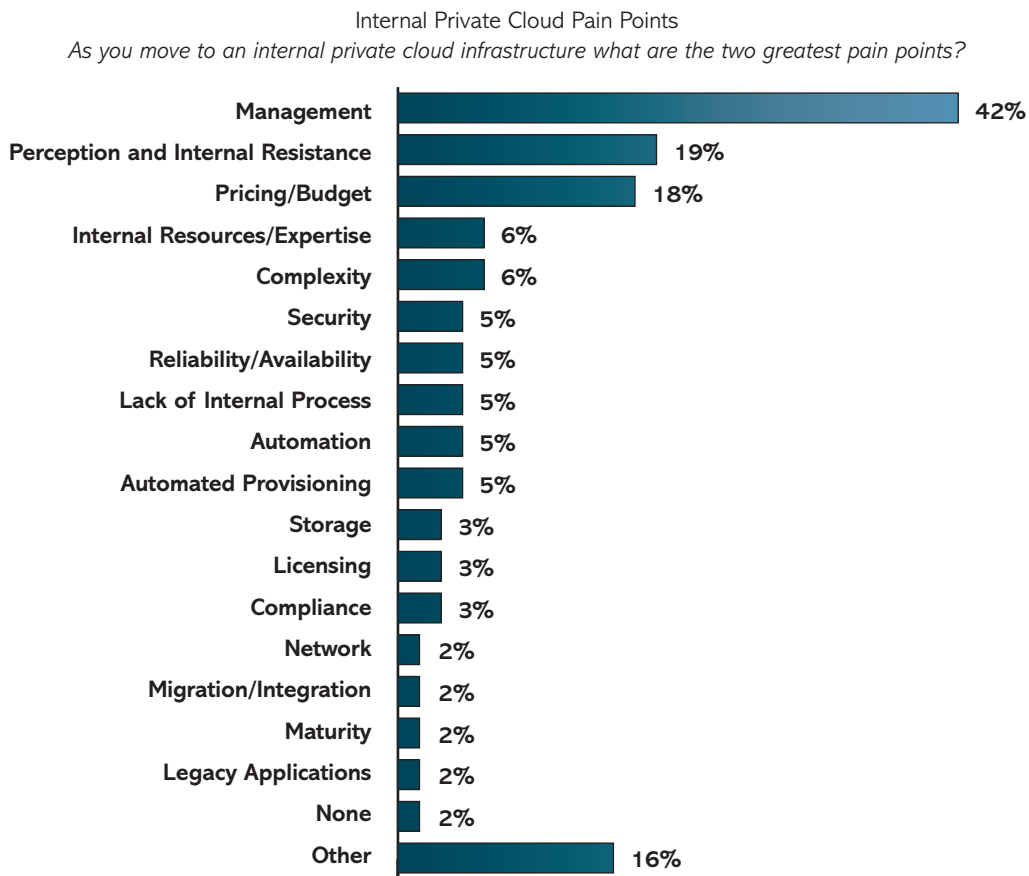82% Not In Plan

Public Cloud Management
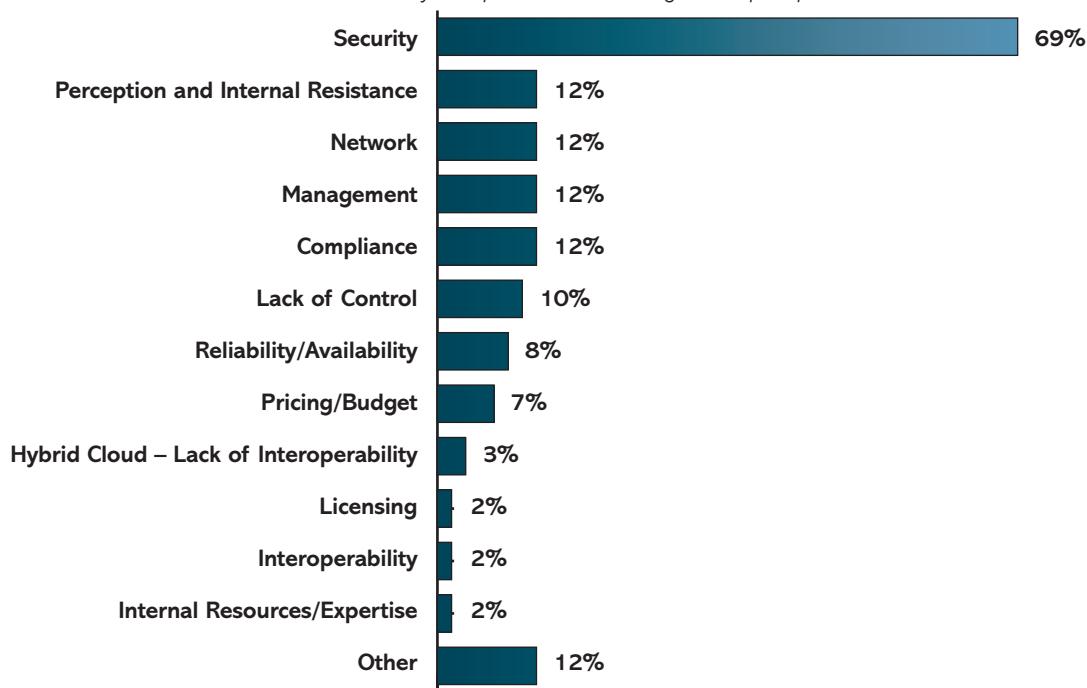10% In-Use
78% Not In Plan

3.3 PAIN POINTS

The fact that management and security are far ahead of anything else when it comes to the pain points of moving to internal private and public clouds, respectively, is no surprise (see Figure 27). Security was cited by 69% of respondents as a pain point for moving to public clouds, while internal resistance is a distant second with 12%. Security concerns typically revolve around data privacy and protection – issues already well covered in 451 Research's security practice. We suspect that for many respondents, compliance is rolled up in the security piece.

We've included a separate category calling out compliance for those who mentioned it as a discrete concern from overall security. Internal resistance is also a considerable threat to the adoption of public cloud services, since IT practitioners often view the public cloud – either rightly or wrongly – as a threat to their jobs.

FIGURE 27: PAIN POINTS IN CLOUD ADOPTION

Internal Private Cloud Pain Points
As you move to an internal private cloud infrastructure what are the two greatest pain points?

Pain Point	Percentage
Management	42%
Perception and Internal Resistance	19%
Pricing/Budget	18%
Internal Resources/Expertise	6%
Complexity	6%
Security	5%
Reliability/Availability	5%
Lack of Internal Process	5%
Automation	5%
Automated Provisioning	5%
Storage	3%
Licensing	3%
Compliance	3%
Network	2%
Migration/Integration	2%
Maturity	2%
Legacy Applications	2%
None	2%
Other	16%

External Public Cloud Pain Points*
*As you move out to the external public cloud,
what is or what do you expect to be the two greatest pain points?*

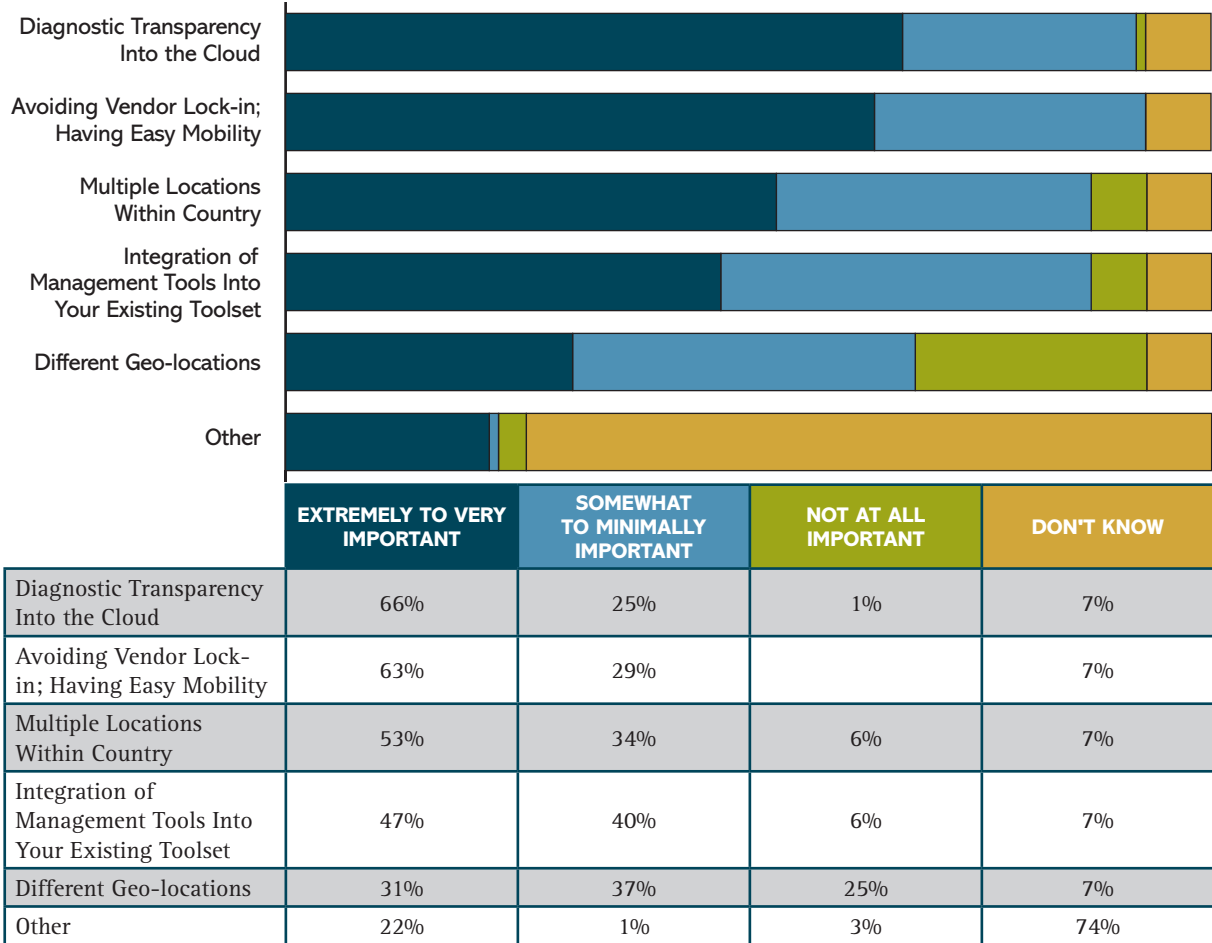| Category	Value
Security	69%
Perception and Internal Resistance	12%
Network	12%
Management	12%
Compliance	12%
Lack of Control	10%
Reliability/Availability	8%
Pricing/Budget	7%
Hybrid Cloud – Lack of Interoperability	3%
Licensing	2%
Interoperability	2%
Internal Resources/Expertise	2%
Other	12%

3.4 CHOOSING A PROVIDER

What attributes do end users value most when making provider decisions? First and foremost, end users want to build a 'trusted' relationship (not just choose a trusted brand) with their service-provider partners. This translates into a need for control, manageability and transparency (see Figure 28). End users also tend to favor service providers that don't lock them into their platform. So, if things don't work out, end users want the ability to switch to another provider or bring their workloads back in-house. This is evidenced by the 66% of end users who said that avoiding lock-in and ease of mobility are both either extremely or very important factors in their service-provider selection decisions.

FIGURE 28: PUBLIC CLOUD PROVIDERS: SELECTION CRITERIA

When looking at external public cloud service providers, apart from just evaluating SLAs, how important are the following features to your buying decision?

	EXTREMELY TO VERY IMPORTANT	SOMEWHAT TO MINIMALLY IMPORTANT	NOT AT ALL IMPORTANT	DON'T KNOW
Diagnostic Transparency Into the Cloud	66%	25%	1%	7%
Avoiding Vendor Lock-in; Having Easy Mobility	63%	29%		7%
Multiple Locations Within Country	53%	34%	6%	7%
Integration of Management Tools Into Your Existing Toolset	47%	40%	6%	7%
Different Geo-locations	31%	37%	25%	7%
Other	22%	1%	3%	74%

TIP*Network* Quotes

We absolutely need to avoid lock-in – anything not looking open would be disregarded.

Avoiding vendor lock-in is the same as cost in my mind. You get locked in, you're at the mercy of price increases.

Hardware seems to be commoditized.

SECTION 4
The Cloud Provider Ecosystem

The major competitive forces operating on the public/private cloud ecosystem battle-ground are VMware and Amazon. Other combatants include the OpenStack community, which is focused (mainly) on Amazon; Citrix, which has VMware in its sights; and Microsoft and Google's new IaaS efforts, also focused on Amazon.
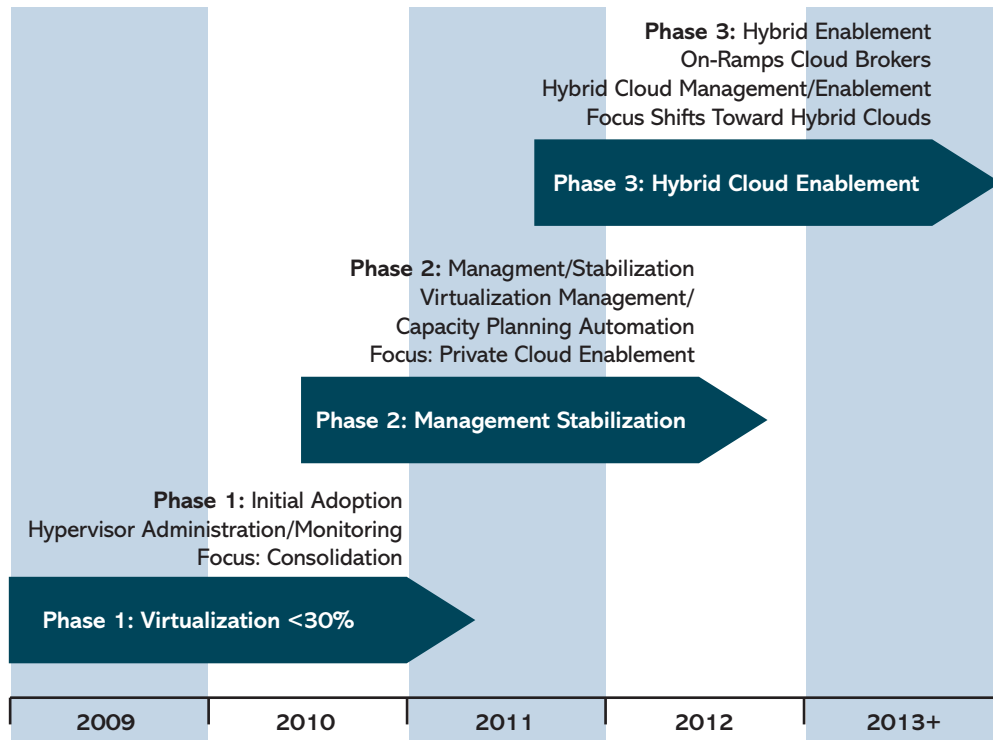
FIGURE 29: THE CLOUD BATTLEGROUND
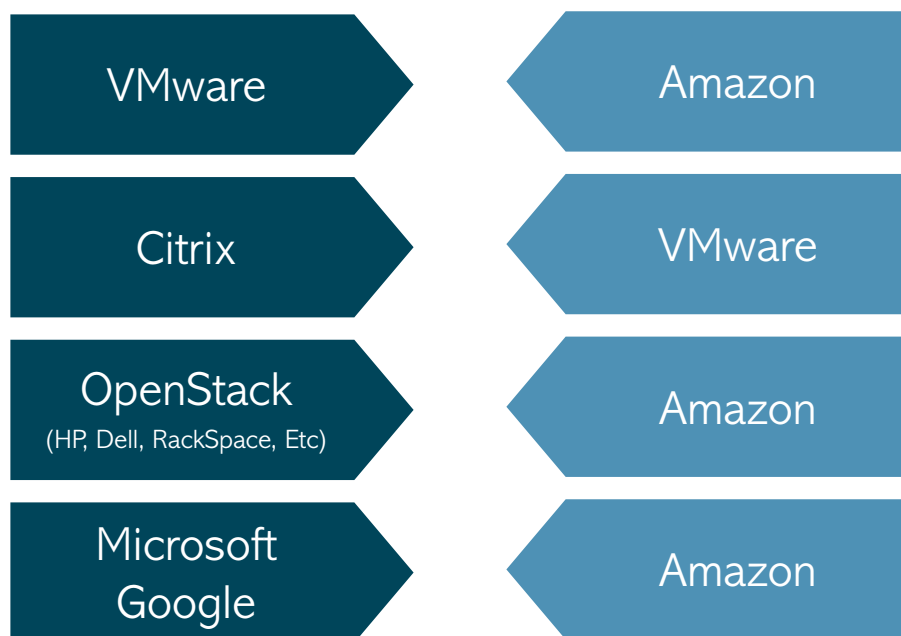
As a first step on their cloud journey, many organizations are first building highly virtualized and automated environments internally (using VMware, Citrix and other vendors) as they look to replicate cloud service-provider efficiency and scale, while maintaining control over their environment. To this end, users are moving datacenter applications into this modern world with virtualization – mostly VMware – as the backdrop for a private cloud.

At this point, what external clouds offer is a way to access additional capacity without buying more datacenters (better economics) and to achieve better flexibility. Private/internal cloud – whatever the particular definition of it – implies a finite or ring-fenced resource environment. To realize the illusion of infinite capacity, a user will need to tap a hosting partner to provide an additional elastic capacity.

FIGURE 30: PRIVATE AND HYBRID CLOUD EVOLUTION

Phase 3: Hybrid Enablement
On-Ramps Cloud Brokers
Hybrid Cloud Management/Enablement
Focus Shifts Toward Hybrid Clouds

Phase 3: Hybrid Cloud Enablement

Phase 2: Managment/Stabilization
Virtualization Management/
Capacity Planning Automation
Focus: Private Cloud Enablement

Phase 2: Management Stabilization

Phase 1: Initial Adoption
Hypervisor Administration/Monitoring
Focus: Consolidation

Phase 1: Virtualization <30%

| 2009 | 2010 | 2011 | 2012 | 2013+ |

There are a raft of VMware vCloud-based IaaS providers now available to host users' virtualized applications and workloads as they seek to move VMware virtualized estates out into the cloud. On the flip side, users get going with public clouds (chiefly Amazon) because they develop new applications, and fire up new projects and products (or companies) directly onto an IaaS platform without buying any equipment.
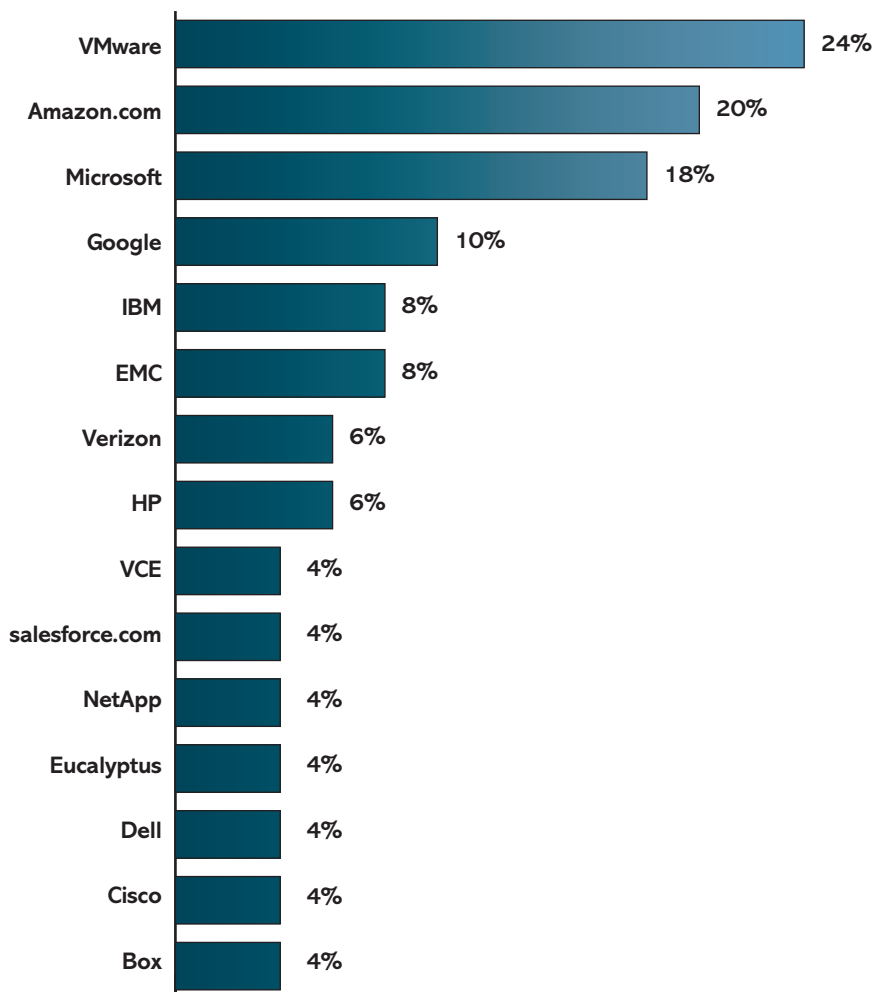
As these kinds of projects become stable and start to operate at scale, they're likely to become targets for re-housing internally – workloads will be pulled back inside the organization. Already available are a range of Amazon-compatible infrastructures (software and hardware) for use as internal systems from the likes of Eucalyptus, OpenStack, Nimbula and many others. As in the case of VMware, it means users should be able to move workloads between internal and hosted resources based on any number of characteristics, including cost.

Users' Choice: Exciting Vendors

With such a wealth of offerings to choose from to assemble cloud strategies, the TIP survey base was asked to identify those products and services that have caught their eye. Interestingly, Figure 31 has a mix of established vendors and incumbent suppliers, plus new entrants on both sides of the fence – both private and public.

FIGURE 31: CLOUD PRODUCTS & SERVICES: EXCITING VENDORS

Which one or two vendors have the most exciting cloud-related products
or services you've seen in the past 12 months?

Vendor	Percentage
VMware	24%
Amazon.com	20%
Microsoft	18%
Google	10%
IBM	8%
EMC	8%
Verizon	6%
HP	6%
VCE	4%
salesforce.com	4%
NetApp	4%
Eucalyptus	4%
Dell	4%
Cisco	4%
Box	4%

OTHER EXCITING VENDORS MENTIONED	
Apple	OneLogin
AT&T	Parallels
BMC Sftw	Penguin Computing
Brocade	Rackspace
Citrix	RightScale
Dropbox	Riverbed
HDS	Veeam Sftw
MobileIron	Workday
Nasuni	

SECTION 5
Conclusions

So what does all of this data tell us? Is the reported and projected market development really translating into greater appetite for and accelerated adoption of public and hosted cloud services among enterprise end users?

We have detailed the different starting premises, audiences and findings from some of the 451 Research properties that have a quantitative lens pointing at the cloud computing market: CloudScape, Market Monitor, ChangeWave and TheInfoPro. Although they appear at first glance to have somewhat contradictory findings, on closer examination of both demographics and definitions, we can conclude that: cloud adoption is growing fast; that cloud computing is being used quite widely (>50% for SaaS); and that cloud is 'punching above its weight' in terms of market perception.

However, while cloud computing is benefitting from a rudely outsize market perception and generous M&A valuations – and boasts a tremendous number of new market entrants – this is all coming off what is a small revenue base, of course.

Remember, too, that Amazon's EC2 – where all of this effectively started – has just celebrated only its sixth birthday. Moreover, spending on cloud services, however it's sliced and diced, remains a relatively small part of overall enterprise IT spending, and in the overall workload estate, the cloud occupies just a small – but strategically crucial – place.

When we consider cloud computing relative to the cart it is seeking to overturn – namely, traditional hosting, managed services and colocation – the delta between the propaganda and the reality is stark. This is illustrated in Figure 32. But while cloud's future place is clearly within our industry's ken, this won't be a straightforward 'David and Goliath' encounter. The incumbent market owners have as much opportunity – if they're bold enough – to tackle this market with cloud services of their own.

FIGURE 32: PUTTING IT IN CONTEXT: GLOBAL HOSTING MARKET VS. CLOUD
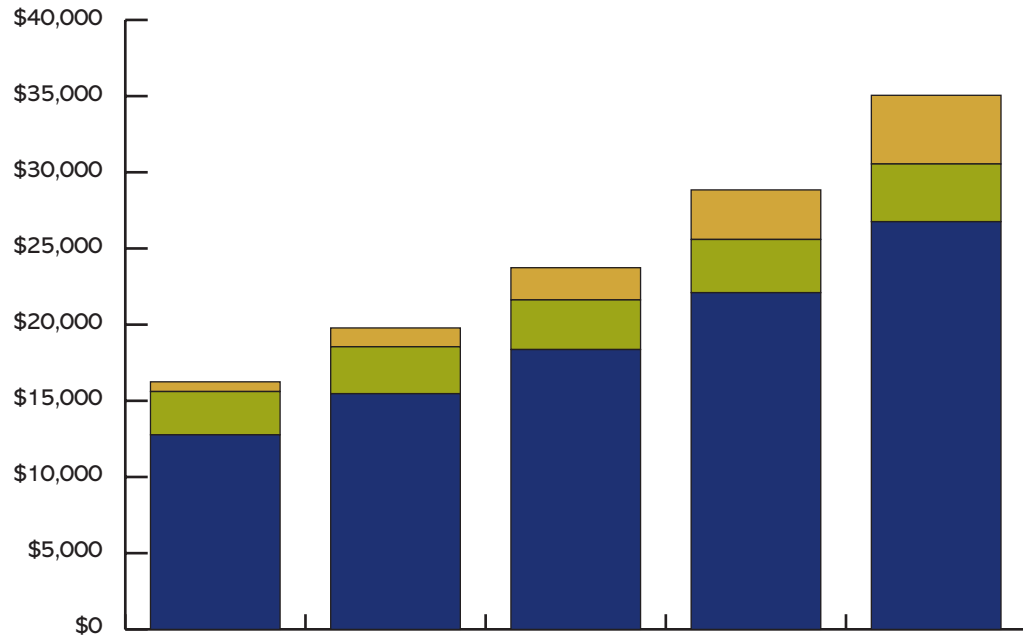
		2010	2011	2012	2013	2014
	Infrastructure as a Service	$681	$1,397	$2,444	$3,755	$5,169
	Dedicated Hosting	$3,078	$3,257	$3,490	$3,787	$4,177
	Managed Hosting	$12,808	$15,524	$18,839	$22,908	$27,893

INDEX OF COMPANIES